Heating Piping & Air Conditioning

with which is merged the Aerologist

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February 1949 . . . . . Vol. 21. No. 2

The Editor's Pages (news, notes, and comment) 63

"Open for Discussion" (a regular feature) 67

How to Service Industrial Oil Burners, by Kalman Steiner 71

Single and Double Duct Systems Condition Prudential's Building, by Ralph E. Phillips and Louis H. Wagenbrenner 77

Re-Insulating Underground Piping, by Robert Levy 80

Sizing the Piping for Steam Supply and Condensate Return, by R. G. Lubinsky and M. J. Williams 82

Effect of Entrance on Flow of Fluids (a comment) 84

Direct Fired Heaters Serve Plywood Warehouse 85

Eliminating Fire Hazards in Windowless Buildings, by Howard C. Murphy 86

Store Demonstrates Smoke Exhaust System 87

Air Conditioning Aids Biological Research 88

Convenience Features Laboratory Piping 89

How to Heat Low Rent Housing 91

More Power for Gas Compressing, by W. W. Armstrong 93

Sam Lewis' Page—Practical Pointers on Use of Heating, Conditioning Control 95

Question of the Month—Ratings for Old Radiators 97

Industry Leaders Predict Busy 1949 100

Pressure Vessel Head Theory Perfected 102

Data Sheet—Instructions for Installing and Operating Reciprocating Pumps 103

Are Radiant Heating Jobs Overdesigned? 104

Equipment Developments 159

Who's What 173

New Books & Reports 177

Meetings & Conventions 180

Recent Trade Literature 184

Index to Advertisers 198

Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc.

Journal Section of the American Society of Heating and Ventilating Engineers

Physiologic Adjustments of Normal Subjects and Cardiac Patients to Sudden Change in Environment, by Nathaniel Glickman, Tohru Inouye, Robert W. Keeton, M.D., Irwin R. Callen, M.D., Ford K. Hick, M.D., and Maurice K. Fahnestock 105

The Internal Performance of an Induced Draft, Packed Cooling Tower, by N. W. Snyder 111

Summary of Local Chapter Meetings 119

Candidates for Membership 127

Officers, Council, and Committees 131

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THE EDITOR'S PAGES

BUILDING CONTRACTS SET RECORD

Building and engineering contracts in unprecedented dollar volume were awarded in the 37 states east of the Rocky Mountains last year, it has been reported by the F. W. Dodge Corp.

Contracts awarded aggregated $9,429,618,000 to top the 1947 volume by 22 percent and to exceed by 14 percent the previous record set in 1942 when the war construction program was at its peak.

The record in investment commitments for building and engineering works was attributable mainly to extraordinary volume of nonresidential building which was designated in federal government regulations from 1941 to midyear 1947 as "nonessential." The classes showing the greatest gains, and the percentage increases over 1947 were: commercial building, 25 percent; educational and science building, 85 percent; hospital and institutional building, 111 percent; religious building, 109 percent; social and recreational building, 90 percent.

ANNOUNCE ROYALTY FOR UNDERGROUND GAS STORAGE

D. V. Meiller and M. G. Markle, who are associated with the Public Service Co. of Northern Illinois in gas engineering work and who invented a system for the underground storage of natural gas in pipe sections and under high pressure, have announced adoption of a policy which will make available to any prospective user of the system a license under their patent rights at a low uniform royalty rate.

Licenses, they said, will be granted to any responsible parties who wish to install or have installed a high pressure gas storage system covered by their pending patent application.

The underground gas storage system developed by them already has been used successfully in installations having a capacity of more than 95,000,000 cu ft of natural gas.

In the light of constantly increasing demands for natural gas, this high pressure, underground storage system, described in detail in the May 1948 HPAC, has recently attracted considerable attention from utility companies and manufacturers interested in the storage of natural gas for reserve or emergency supplies.

CERTIFIED FAN RATINGS ANNOUNCED

The buying public, under a plan announced by the National Association of Fan Manufacturers, General Motors Bldg., Detroit 2, will be "afforded a better means of selecting fans on the basis of capacity and performance."

Recognizing the public interest in maintaining a uniform method of testing centrifugal, axial and propeller fans, the NAFM has for many years sponsored research independently and in collaboration with the American Society of Heating and Ventilating Engineers. Under the sponsorship of these two organizations, with the cooperation of the American Society of Mechanical Engineers, the Standard Test Code for Centrifugal and Axial Fans was developed and promulgated.

In order for the public to identify fans that have been tested and rated in accordance with the standard test code, the association has adopted an identifying "certified ratings" seal or label. The label may be used on fans manufactured and in publications, advertising, and other printed matter.

The NAFM will license the use of the seal or label to a fan manufacturer who is willing and able to accept certain responsibilities and obligations. Under the license agreement, the manufacturer agrees (1) to publish fan ratings which are the result of tests made in accordance with the standard test code, and (2) to maintain manufacturing control of fans manufactured within specified tolerances. These tolerances require the fan to operate within certain limits of speed and horsepower as compared to the published values.

Since the association wishes to render a public service, no charge is made for the license agreement. The purpose of the plan is to assure continued and increasing confidence in the catalogs, bulletins, representations, and products of the fan industry.

TELL 'EM BEFOREHAND

In a discussion of job evaluation, psychological factors in personnel work, establishing salary schedules, etc., before a recent meeting of the Illinois chapter of the American Society of Heating and Ventilating Engineers, Dr. Joseph King mentioned that management should inform the working force *ahead of time* of any innovations or new procedures, in order to assure their whole-hearted acceptance.

This would apply equally as well to a new air conditioning installation, he believes. If the employees of a large general office, or the tenants of an office building, for example, are told of the plans for installing air conditioning before the final decision is made, acceptance of the new facilities will be closer to 100 percent than would be the case otherwise.

DEVELOP SENSITIVE DIFFERENTIAL MANOMETER

A differential manometer that will detect pressure differences as small as one millionth of an atmosphere over a range of total pressure from 1 mm of mercury to one atmosphere has been developed by Harry Matheson and Murray Eden of the National Bureau of Standards. This instrument, which operates on the principle of the aneroid barometer, can be used to compare pressures of gases, organic vapors, and noncorrosive liquids.

It is particularly useful in vapor pressure work, since less than a drop of liquid is sufficient to compare an unknown vapor pressure as a function of temperature with that of a known liquid. The rest point of the new manometer is insensitive to temperature, and accidental pressure differences as high as an atmosphere introduce only temporary hysteresis effects. The instrument is also readily portable and need not be leveled before operation.

THE EDITOR'S PAGES

COMPLETE MEETING, SHOW DETAILS TO APPEAR

The complete "proceedings" of the 55th annual meeting of the American Society of Heating and Ventilating Engineers, held in Chicago last month, a story on the entertainment functions, and a report on "side-line" activities will be published in the ASHVE Journal Section of HPAC. Many of the technical papers presented at the meeting have already been published in the Journal Section. Others are given this month, and the rest will be printed in future issues, as will the discussion on them.

The 9th International Heating, Ventilating, and Air Conditioning Exposition, which is sponsored by the ASHVE, was held in conjunction with the meeting and a "preview" of exhibits was published in the special Show Section in our January number. Further details of the new and improved products displayed at the exposition will be given in our Equipment Developments section.

It has been announced that the ASHVE's 1950 annual meeting—and the 10th International Heating, Ventilating, and Air Conditioning Exposition—will be held in Dallas next year.

HOW WEATHER AFFECTS ELECTRICAL DEMAND

How the habits of man and special events and weather form a "scoreboard" for power companies in estimating load requirements was detailed before the American Society of Civil Engineers at its fall meeting. Man is such a creature of habit that, in most instances, his electricity requirements can be forecast within 1 percent, C. P. Corey, chief system dispatcher, New England Power Co., Millbury, Mass., told the power division of the **ASCE.**

"Habit may vary somewhat in different areas, but tends to become fixed in a given locality. In time, these local habits come to be talked of as 'the normal routine,' 'lunchtime,' 'bedtime,' or 'time to get up.' In dealing with large numbers of people it is safe to assume that most of their acts on any given weekday will duplicate the acts upon the previous weekday. This fact establishes a pattern of electrical demand and renders reasonable assurance that all electrical appliances in existence will not be turned on simultaneously, a circumstance which would call for tremendous plant investment.

"A further assurance is given by the reluctance of a population to change living habits suddenly. Changes in habits, however, will be reflected in the load and give warning to the utility man who watches for such trends.

"Events affect the load, but their effect—barring war or major catastrophe—is generally of short duration. Holidays are an exception to this statement, of course, for here an event is effective throughout years; this exception is so well established after a few years, however, that it falls into the category of habit. The effect of most events is to increase the load for a short time, usually in the evening. Events of this type include sports events, elections, important public addresses, etc., and call for increase in lighting and radio load.

"Weather affects the demand by changing the requirements for lighting, heating, or air conditioning. Less common, but occasionally met with, are instances where storms keep workers from their employment with a consequent decrease in demand. The effect of weather is subject to a reasonable analytical appraisal. Some approximate statistics for a load embracing urban and rural elements would be:

"A very dark weekday may cause an increase of about 6 percent in total demand over that experienced on a bright day.

"In the winter, using the load observed at 45 F on a calm day as a base, an increase of about 0.15 percent per degree drop may be experienced between 7:00 a.m. and 11:00 p.m. Extreme wind conditions may add as much as an addi[tional] 1.5 percent to this increase. In[crease] in use of house insulation [may] shade this figure in the futur[e].

"In the summer, using a [cool] weekday with an average tem[pera]ture of 80 F as a base, an in[crease] of about 0.20 percent per degr[ee] may be experienced in the 80[-]F range during the 7:00 a.m. t[o] p.m. period on weekdays. Tem[pera]tures of 95 F and above may [bring] about a decrease in load due t[o] tailment of operations becau[se] heat."

15 Years Ago

In the ASHVE Journal Section of the February 1934 HPAC, the list of exhibitors for the third International Heating & Ventilating Exposition (held in New York City that month) totalled some 125 names. Quite a difference when compared to the ninth of these industry shows held last month, when 300 exhibitors filled the International Amphitheater in Chicago! Three of the papers presented at the ASHVE's 1934 annual meeting were also published in that issue, and covered solar radiation studies through bare and shaded windows, observations of hay fever sufferers in an air conditioned room, and comfort cooling with attic fans. The report of the society's committee on research for the year 1943, also printed that month, showed a total budget of $21,865.14 and actual receipts of $16,543.92. Again quite a difference between then and now!

* * * * *

The leadoff article in the February 1934 HPAC was the first of a series by Perry West, consulting engineer, explaining the "why" and "how" of utilizing the heat in exhaust steam for space heating, water heating, air conditioning, drying, and process work . . . Sabin Crocker continued his articles on the code for pressure piping with a discussion on computing the thickness of pipe.

* * * * *

Add the new products described in the Equipment Developments department in Heating, Piping & Air Conditioning each month to the Directory Section published in the January issue, and thus keep your records of sources of supply up-to-date throughout the year.

"OPEN for DISCUSSION"

DO YOU HAVE something to say about any of the articles published this month? An additional comment, or perhaps a question on some point? We follow here the custom of engineering society meetings in allowing a period for discussion following presentation of a paper. You are invited to contribute your views. Address them to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2

WHAT IS RIGHT RADIANT HEAT WATER TEMPERATURE?

THE OPPORTUNITY to learn from experience should always be accepted, and I believe the readers of HPAC are very fortunate in being able to share the experiences of an outstanding engineer like Samuel R. Lewis. The radiant heating lessons he outlined in the January issue are interesting, but I believe that some qualification of his recommendation regarding maximum water temperature is desirable.

While the radiant heating coils and exposed radiators should each have a separate circuit, I believe it is questionable to fix 120 F as the upward limit. The floor surface temperature resulting from water temperature will certainly vary with the floor construction, and thus if 120 F is acceptable for a 1½ or 2 in. cover of concrete over the piping, a somewhat higher temperature should be acceptable with thicknesses between 2 and 8 in. Also if rugs, wood block, or other floor coverings are to be placed over the bare concrete, we must expect to have water above 120 F in most cases.

While I would not advocate temperatures as high as the 200 F mentioned in Mr. Lewis' article, many a good 6 in. concrete slab in a garage or similar building is today carrying water as high as 150 F. Piping in concrete floors covered with wood block flooring is normally carrying water in the 130 and 160 F range. In some church structures where auditoriums and other rooms are used only intermittently during the week, a quick pickup control system is sometimes installed to enable bringing the large areas rapidly up to temperature. Such a control system will permit the flow of water up to about 160 F in temperature until the room air temperature is within a few degrees of that desired, at which point it is manually or automatically cut out and a standard control system takes over. Occasionally the pickup control system is supplemented by a floor bulb, the purpose of which is to limit floor surface temperature to approximately 90 F.

While these are but a few of the instances in which water temperatures above 120 F can be justified, I believe they are sufficient to enable us to arrive at the conclusion that a maximum of 120 F is an applicable limit for only certain specific conditions, some of which might be pointed out from Mr. Lewis' experience. There are so many different conditions of construction and function that it would be practically impossible for anyone to establish a limit for every case and thus the judgment of the individual engineer is required. With handbook data lacking, there seems to be no other better source of information than someone's experience.—PAUL S. PARK, manager, engineering service dept., A. M. Byers Co., Pittsburgh.

RADIANT HEATING IS STILL CONTROVERSIAL

THE ARTICLE by J. K. Fairbairn and R. P. Goemann in the January issue proves only that the highly controversial subject of radiant heating is still controversial.

The authors scorn the theoretical calculations and laboratory checks made by various authorities and for an answer turn to the Stefan-Boltzmann formula and Nusselt's value. These factors have a proven worth as a basis for study and for carefully controlled laboratory experiments; however, in the field, their value is doubtful because of the many variables.

It has been the practice of this writer to design radiant heating installations on the basis of Professor Giesecke's published data, along with other information concerning surface temperatures, piping, etc. This method is by far less involved and, what is more important, has enabled us to design many installations that operate to the satisfaction of all concerned.

A review of numerous jobs that we have designed and that have been built in accordance with this method discloses instances in all of them where parts of the systems may have been oversized, yet in none of them was the extent of oversizing the same.

This would seem to indicate that even though the same method was used in all cases, indeterminate variables affect the design to a marked degree. From experience it is evident that less coil could be installed and still do a satisfactory job but a healthy respect of those "indeterminate values" forestalls any urge to experiment with a client's money.

I feel that, though Messrs. Fairbairn and Goemann have attempted to throw light on the subject of radiant heat, they have failed to simplify the method of computation or produce any startling facts that would enable an engineer safely to reduce the size of a system without fear of underdesigning.—H. W. SCHIEWE, Samuel R. Lewis and Associates, engineers, Chicago.

ERECTING HIGH TEMPERATURE PIPING

ARTHUR GOULD has done an excellent job in his article on erecting high temperature, high pressure piping in the January HPAC in covering a subject which has not enjoyed much publicity; his paper is a distinct contribution to the industry.

The author focuses attention upon a number of excellent points. Our only comment would be to emphasize the importance of the statement that the "temporary struts and bracing should not be welded to the pipe indiscriminately, etc." We have encountered instances where this was done in connection with alloy piping without taking into account the possible aftermath as so ably portrayed by Mr. Gould.—G. W. HAUCK, manager, engineering sales, Crane Co., Chicago.

"OPEN for DISCUSSION"

SELECTING CHILLED WATER COILS

F. F. STEVENSON's points on selection of cooling coils in the December "Open for Discussion" columns are well taken, but it seems to me they are more applicable to the problem of how a manufacturer should rate the performance of chilled water coils and how such ratings should be applied in practice.

The various manufacturers have developed different procedures for this purpose, but they all start in the middle of the problem as it is presented to the engineer—they all start from the point where the air quantity with its entering and leaving conditions and the water quantity and its temperature are known or assumed. These values can be (and frequently are) such that either no coil can meet the requirements, or the overall design is not the most economical.

In my article on the subject in the September HPAC, I attempted to provide some guide that would enable the engineer to select values for air quantity and entering water temperature that would result in a specified coil performance corresponding—at least fairly well—to normal coil characteristics so far as the division of the total load between sensible and latent is concerned, and at the same time provide something like the most economical overall cost for the system. Insofar as the actual determination given of the rows deep of the coil is concerned, this was done only to show that if the air quantity and initial water temperature were not properly selected with respect to the room load and its division between latent and sensible heat, there could result a specified coil performance which either no coil could meet or which would require a higher than necessary overall expenditure for the system.

I have no desire to argue the merits of any coil manufacturer's method of rating or method of coil selection. I assume that if the selection method of any reputable coil manufacturer is followed, the coil chosen will perform according to its rating and meet the requirements of the specifications—provided only that the specified performance is possible for the particular type of coil selected. It was with this assumption that the method followed in determining rows deep in my article was used.

The particular method used is that of a widely accepted manufacturer who employs the surface temperature concept. This so-called "surface temperature" is not an actual measured temperature of the surface, for, as Mr. Stevenson points out, the temperature of the surface varies in different parts of the coil. It is only an engineering concept and is really the temperature to which the air passing through a coil would be cooled if the cooling process were carried to complete saturation with air entering the coil at given conditions and water entering the coil at a given temperature. The correctness and value of this concept were beyond the scope of my article.—J. A. BISHOP, district manager, American Blower Corp., Dallas.

HOW REDUCE SCALE ON EVAPORATIVE CONDENSERS?

HERE ARE my comments on Reducing Scale on Evaporative Condensers, by O. Germany, in the January issue, page 104:

Again Mr. Germany is to be complimented on his sincere and careful analysis of the scale formation problem with evaporative condensers and again I wish to take exception to the claim that a desuperheating coil, per se, can in any way reduce scale formation.

The statement has often been made that the use of a desuperheating coil by removing part of the heat will relieve the remainder of the condenser of part of its load, reduce the condensing temperature, decrease the rate of heat transfer per square foot of surface, and reduce scale formation. This would be true if desuperheating coils were supplied "for free," but they ar[e] not. Condensers are selected for [a] particular job to operate at a spe[cified] condensing temperature. Thi[s] may be varied over a rather wide [ran]ge by the selection of a larger or [sm]aller size of condenser. All ma[nu]facturers credit the condenser wi[th] the heat removal of a desuperh[eat]ing coil. Thus, addition of the des[u]perheating coil performs the [same] function as selecting a large[r] size condenser.

It is granted that the selection of a larger size of condenser to op[erate] at lower head pressure will de[crease] scaling and this is true whether the increase in size is the result of adding more surface to the tube bundle or adding a desuperheat coil.

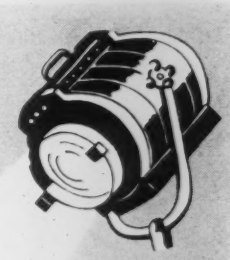
This is getting down to rather fine points and somewhat away from the central issue, which is "the superheated gas entering an evaporative condenser does not cause any appreciable increase of scale formation and therefore broad claims that have been made for desuperheating coils reducing scale formation are entirely unsubstantiated."

Examinations of a large number of evaporative condensers operating under all sorts of conditions and of various designs have proved conclusively that scale forms more rapidly at the bottom of the tube bundle where no superheat is present. Mr. Germany has pointed out reasons for this and has suggested certain remedies. To his suggestions I wish to add the importance of *circulating a suitably large quantity of spray water, distributing this spray water evenly over the tube bundle, and providing a positive bleed arrangement which will prevent excessive concentration of minerals in the spray water.*—D. D. WILE, chief engineer, Refrigeration Engineering, Inc., Los Angeles.

HPAC INDEX FOR 1948 IS AVAILABLE ON REQUEST

An index for our 1948 issues, Vol. 20, Nos. 1-12, including the Journal Section of the American Society of Heating and Ventilating Engineers, is being compiled and will be available soon to HPAC's subscribers on request. If you want a free copy, send a note or postcard to The Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

KALMAN STEINER, C. Hoffberger Co., Baltimore, member of HPAC's board of consulting and contributing editors, and author of some excellent books on fuels and burners, turns the spotlight on service in this article, with a host of helpful and practical suggestions to simplify the job which are based on a wide experience with oil burning equipment



How to *SERVICE* INDUSTRIAL OIL BURNERS

In the early days of industrial oil burners, servicing them required little more of the service man than verifying that the strainers were clean, that the fuses were okay, and that the motor was not burned out. Today's burners involve much more technique, and require a more ample versatility on the part of the service man—a knowledge of and competence in handling electronic equipment, various types of draft regulators, combustion controllers, viscosity and flow valves, motorized valves, electric and exchange type preheaters, and a host of related apparatus—such as boilers and appurtenances, pumps, etc.

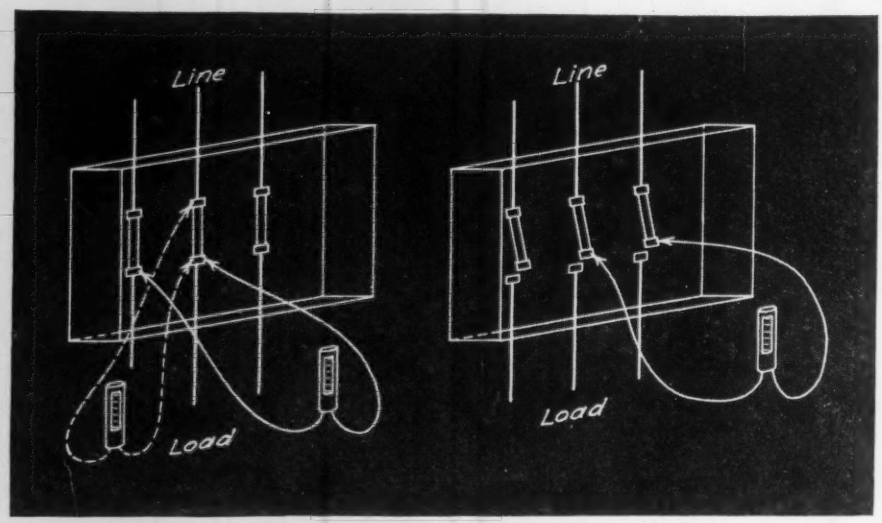
Four Major Service Groupings

It is convenient to classify service operations under four major headings or groupings: electrical apparatus and circuits, the fuel supply system, combustion problems, and maintenance. Like all broad classifications, there will be overlapping, of course, but at least this arrangement will serve as a guide and should answer our purposes here as well as any other.

Electrical systems must again be subdivided into two kinds—those involving only magnetic relays and switches, and those involving electronic circuits. Most practical and operating men are familiar with conventional electrical circuits and little mention need be made of them here. In industrial plants, the most common electrical power supply is three phase, 60 cycle, either 220 or 440 volt. When a burner stops running, or fails to start when it should, the service man first verifies his power supply, testing fuses, examining switches, checking relays. If a motor hums but won't run, chances are one line is open (a fuse blown, a bad contact, etc.) or the shaft is frozen (bad bearings, broken gear, too tight gear mesh).

In testing for an open fuse on a three phase circuit, a voltage tester held across two lines may give a false reading and fail to reveal the open fuse by reason of feedback through another phase. The bad fuse can be located by either of two methods: (1) removing the lower ends of the fuses from the clips, leaving only the upper ends in the clips and then testing across the lower ends, or (2) leaving the fuses in regular position and testing across the upper and lower ends of the individual fuses. In the latter test, a good fuse will give no voltage reading across its upper and lower ends, but a blown fuse will.

Having established that the power supply has not been interrupted, but the burner still will not start, the service man then investigates the control circuit. The low water cutoff, pressurestat, thermostat, or other temperature controller and other operating controls receive close scrutiny. If all these are closed, then the control circuit wir-



The full lines in the sketch at the left show an improper method of testing for a blown fuse, for feedback may give a false voltage test. The broken lines in this same sketch show one method of properly testing a fuse. At right is shown a second correct method; the fuses have been detached from the load clips

ing is open due to a break in it.

The break can be located by methodically testing for voltage at each control in sequence, starting from the power takeoff at the panel. On a single phase circuit, the voltage tester is held across the control contact and ground. There are some three phase services in which one line is grounded, which will not give a voltage reading to ground. This grounded line should always be made the middle line to the motor, and the control circuit taken across the other two, so that at any point on the control circuit it will be possible to test voltage to ground. This systematic testing for voltage at each control will reveal that the line is broken at some point between two controls, or that a control or switch, although mechanically closed, does not pass current and is internally defective.

Burner Controls Go Into "Safety Lockout"

Frequently, the burner controls go into the condition called "safety lockout," meaning that the combustion safeguard has tripped and the circuit is locked open until the reset button is pushed. Sometimes this condition is caused by the motor overload breaker tripping, which of course stops the motor and causes the combustion safeguard also to trip.

The service expert *never* presses the motor breaker reset first; he invariably presses the combustion reset first. Resetting the motor breaker cannot possibly start the burner, and even though the motor has been tripped out on overload, there is no way of detecting the fact from pressing that reset first. If pressing the combustion reset causes the main burner relay to pull in and bring on the ignition, but does not start the motor, then the next step is to try the motor reset. In this sequence, the fact that the motor starter is off on overload has been proved; the reverse sequence does not prove it. Should the motor overload be proved tripped, then that matter must be investigated, as discussed below under the topic of motors.

Electronic Circuits Require Servicing Skill

We come now to electronic circuits. Even under such mild and unexciting applications as burglar alarms, gunnery control, and artillery fuses, electronic circuits are delicate and call for more skill and care in installation and usage than conventional electrical circuits. But the conditions of high temperature, moisture, and vibration that prevail in oil burner applications in boiler rooms call for the highest degree of expert maintenance. The currents involved are of the magnitude of milliamperes; the photocell is called upon to distinguish between light rays from a flame and light rays from incandescent refractory; soot and dampness can combine to thwart the ablest design; and these systems are expected to operate automatically in many cases with the benefit of little or no local supervision or attention.

Electronic combustion safeguards are designed to lock out the system in event of grounding, as by soot deposit. Failure to start, even when the reset button is pressed, results most commonly from soot deposit, although of course a bad amplifier tube could also cause it. Sooting usually occurs on the porcelain insulator supporting the gas pilot electrode. Grounding can also result from contact of the electrode with the boiler setting, whether metal or refractory. Operating personnel should be instructed to clean away visible soot deposit periodically. In some cases, of course, competent personnel may not be available. In other cases, even though the plant attendant removes visible soot, some soot will lodge underneath metal plates and contacts and be invisible until the service man removes the control and takes it apart.

The cover plate of the flame eye butts against a clip that springs back to ground the circuit whenever the cover plate is removed; this is to prevent operation of the burner whenever the plate is off, for light from an external source might actuate the phototube unless this precaution were taken. However, the clip may fail to open the ground connection when the cover plate is restored to position, a circumstance which the service man may discover when more probable sources of grounding prove okay. Occasionally, an over zealous attendant may open the bypass around the solenoid gas valve of the ignition assembly, permitting a gas flame to continue burning after the burner stops. This has the effect of grounding the electrode and prevents recycling of the burner after the next shutdown.

Electronic primary relays have a timing motor that turns the rotor of a rotary switch, making in sequence the several contacts that start the burner motor, bring on the ignition, open the oil valve, shut off the ignition, stop the burner on flame failure, etc. In some relays, this timing motor and set of contacts are accessible to the service man upon removing a cover plate, although in others the timing switches are not accessible and the

unit must be returned to the factory for service. Where he has access to them, the service man must learn the function of each switch and the sequence of the series, for at times he is called upon to correct the tension in the switch parts to assure proper contact.

Two Lenses Between Photocell and Flame

The gas pilot electrode must prove the pilot, or establish its presence, before the oil solenoid can open. After the oil flame is burning, the gas pilot turns off and the photocell of the flame eye maintains supervision. There are two lenses between the photocell and the flame. The one nearer the flame is of clear glass, and serves to keep soot from puffing backward in the flame eye assembly. The other is a colored lens that filters out the long wave lengths of light radiated from hot brickwork and passes only the short wave lengths from the flame. The clear glass may require daily cleaning, but regardless of how often it forms, a film of soot on it blocks light passage to the photocell and induces shutdown of the burner. This lens is mounted so as to be readily removable for cleaning. The colored lens should not become sooted, since the clear glass ahead of it protects it. Sometimes the thickness of the colored lens must be altered to conform to the light intensity reaching it, and at times an orifice ahead of the lens must be altered in size to regulate the quantity of light admitted to the photocell, but both those matters are really adjustments to be made at the time of original installation.

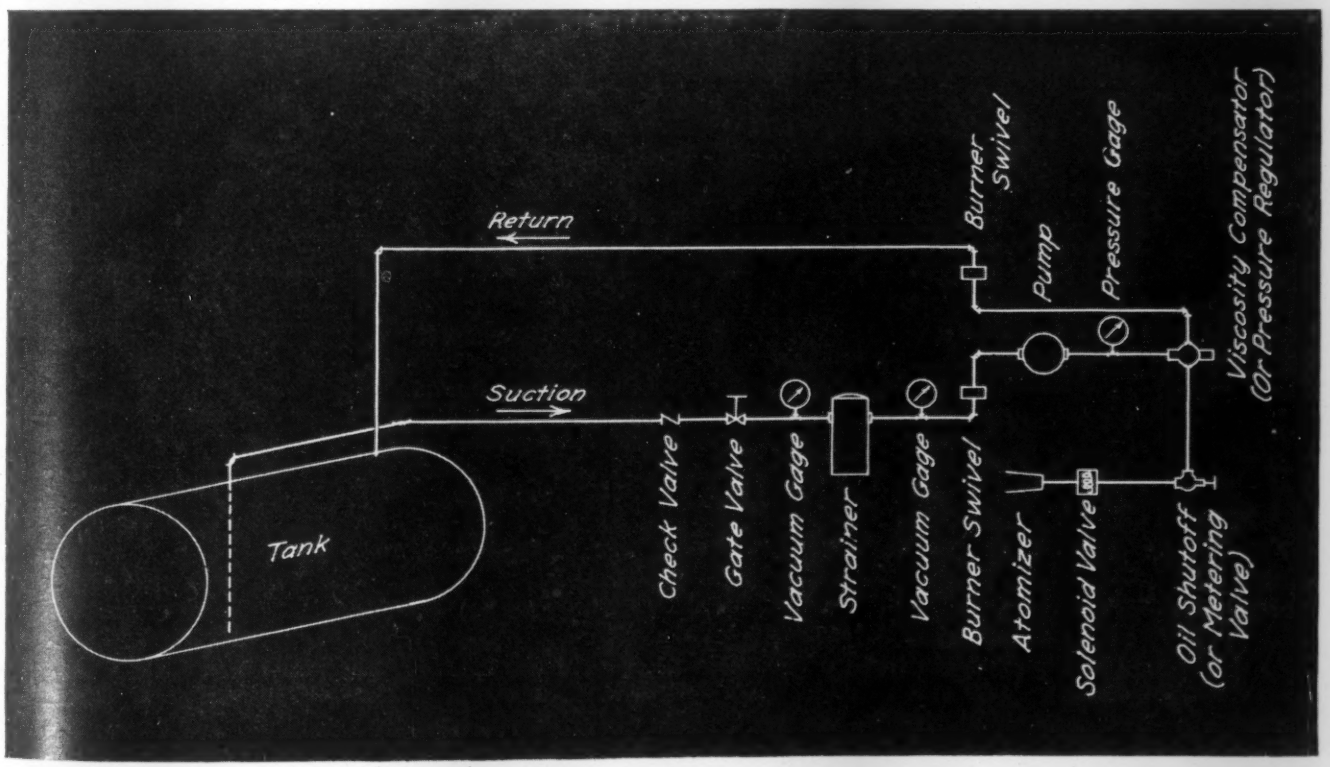
Both the photocell in the flame eye and the amplifier tube (which may be in the flame eye assembly or may be housed in the wall mounted relay) have limited periods of useful life. The quickest and simplest way to test for failure of the photocell is to insert a new one whenever the old one is suspected of being worn out. If the substitution of the new one corrects the operating trouble, that is the answer. In the case of the amplifier tube, it is possible to insert a test fixture that will measure the intensity of the current, in milliamperes, transmitted to the plate. The service man is then able to judge, from a knowledge of the particular requirements of any given relay, whether the plate current is sufficient to actuate the electronic relay.

Power, Control Circuits Clear; Motor Won't Run

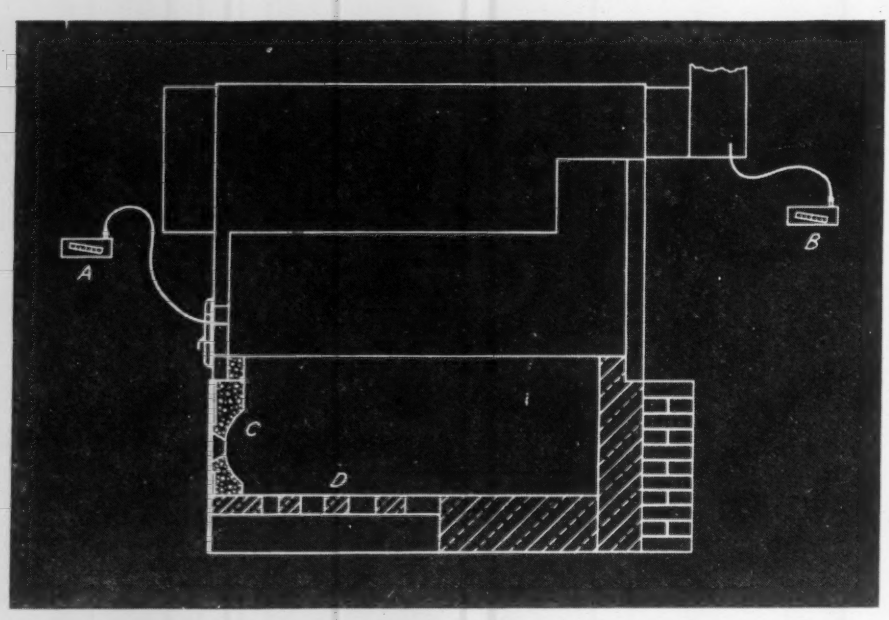
We come now to the eventuality that the power and control circuits are clear but the motor does not run. If it has tripped off on overload, as mentioned above, it may be that the overload elements are too light. The ambient temperature in a boiler room is usually higher than that at which overload elements are rated, with the result that elements corresponding to motor nameplate current sometimes trip the breaker. Usually, an element rated 15 to 25 percent higher than normal will be needed in the boiler room.

If, however, the burner has been in service for a considerable time, then tripping of the overload breaker has deeper significance. A tight bearing could cause the overload, or a rotor loose on its shaft, or a rotor that has a break in the soldered connections around the bars that compose its winding. Overload sufficient to trip the breaker sometimes results from a very heavy lubricant in the gear casing.

If it is not the overload breaker that prevents the motor from running, then of course the motor may be burned out, or, if d-c, the brushes may be worn (also on some types of single phase motors), or there may be a break in the motor leads between the starter and the motor connection box, or even internally between the terminal box and the winding itself. Often there is no remedy short of replacing the mo-



Typical oil pumping scheme for an industrial burner. If the service man finds the electrical system in proper order, he turns his attention to the fuel system



A cross section through a boiler and its setting. Draft loss through the boiler is the difference in gage reading between point "B" in breeching and point "A" in firebox. Carbon formation on refractory at point "C" may mean angle of oil spray is too wide or flare of refractory is too shallow. Carbon on floor at point "D" may mean too little clearance between firebox floor and nozzle

tor (or frequently the stator only). On belt driven burners, the motor may turn without causing the main shaft to turn, or fail to turn the shaft at full speed. The belts are probably too loose; there may be an adjustment that will permit taking up the slack, or it may be necessary to replace the belts that have stretched.

After Checking Electrical System, Try Fuel System

The service man may find the electrical system to be in proper order, but no fire results from the running of the burner. He then turns his attention to the fuel system, comprising the pump, suction line, strainers, valves, discharge and feed lines, pressure regulators and gages, flow controls, etc. He first glances at the pressure gage; if it registers pressure, he looks for trouble on the discharge side of the pump; if it fails to register pressure, he looks for trouble in the pump or between the pump and the tank on the suction side. It is also possible, of course, that the pressure regulator is at fault in not developing pressure.

Assuming there is oil pressure, if no fire results the most likely spot for trouble is in the solenoid valve —a burned out coil, or a broken line connection. Uncovering the leads to the solenoid and holding a voltage tester across them while the burner is running (without fire) tells whether power is being supplied to the coil. If not, then of course there is trouble in the relay that should energize the coil, or in the wiring between the relay and the coil.

Sometimes relay contacts become pitted, or contact springs lose tension. In an electronic system the oil valve contact of the relay is powered through the electronic switch, and failure of the ignition gas flame to touch the electrode will keep the oil valve contact de-energized. In some burners, the circuit to the solenoid oil valve, after leaving the relay, passes through a fan switch which has the function of safeguarding against failure of the primary air supply; there must be pressure developed by the fan before the fan switch will close and permit the solenoid oil valve to open.

But assuming that the circuit to the solenoid oil valve checks out, and that the coil itself is not burned out (a fact that can be established by opening a pipe union on the outlet side of the solenoid valve), then of course the oil passage is blocked between the valve and the atomizer. Where to look for the point of blocking depends entirely upon the particular burner design. There is usually a manual shutoff valve between the pump and the atomizer. A good service man never overlooks the possibility that someone may inadvertently have closed it. Fuel blocking, should it happen, is most likely to occur in the small feed pipe that delivers oil to the atomizer, as that is the point of greatest restriction in the fuel system.

In the case of no oil pressure registering on the pressure gage before starting to analyze the pump and suction line, the mechanic will of course verify that the oil pressure regulating device is operating, if one is used. Some systems employ a viscosity compensating device that may not necessarily develop pressure during normal operation, but most burners have some form of pressure regulator, either singly or in conjunction with a viscosity compensator. In the conventional spring operated pressure regulator, loss of pressure may be due to lack of tension in the spring (remedied by inserting a new one) or worn or pitted surface of the plunger and seat (remedied by either grinding them to a new surface on the job, or replacing them with renewable parts).

Fuel Not Being Drawn From Storage Tank

We come now to the situation where fuel is not being drawn from the storage tank. The trouble lies either in the pump or in the suction line. (The service man has by this time verified that there *is* oil in the tank.)

Here, a vacuum gage is invaluable in tracing the trouble. In fact, logically, there should always be two vacuum gages permanently attached to the system, one on the inlet to and the other on the outlet from the strainer. Any increase in vacuum over the normal operating range across the strainer serves as a fairly accurate index of a fouled strainer.

But taking the usual installation with one vacuum gage located between the strainer and the pump, the service man first notes the reading that prevails "on arrival," i.e., before he does anything. A very high reading, in the range of 20 to 28 in., tells him that the oil in the tank may be very heavy, or the strainer needs cleaning, or the suction line is partially or completely blocked at some other point. A zero reading tells him that the pump is worn, or the pump packing is leak-

ing, or the pump drive is inoperative, or the suction line is leaking.

He now closes the valve in the suction line between tank and strainer and again studies the vacuum gage. If from a low reading the gage swings to a high reading, close to 28 in., then the pump is okay and the trouble lies in the suction line. Space will not permit a detailed analysis here of each step to be taken for every situation established by this check of pump, strainer, and suction line. Half the battle is making the correct diagnosis; once the trouble is localized, the remedy may be very obvious.

When There Is a Preheater

Up to this point, we have treated the fuel system as being an installation burning unheated oil. Where there are preheaters, certain other considerations enter.

A high pressure reading on the pump discharge may mean the preheater is blocked, or that valves in the preheater lines are closed, forcing open the high pressure relief valves and bypassing the oil back to suction or storage. With a high vacuum reading and little or no oil flow, the oil is very viscous; if there is no steam or other heating medium in the exchange heater or tank coil, then the electric heater will have to serve for getting under way. Temporary heat may be applied to the suction line, as by a blow torch, so the oil may be coaxed along to the pump, through the exchange preheater, allowing the electric heater to deliver some fuel to the atomizer. As the boiler heats up, the exchange heater begins working, thinning the oil, speeding the flow, and building up the firing rate until normal conditions once more prevail.

Problems of Combustion and Combustion Control

But the service man may have been summoned even though the burner mechanism is functioning and the plant is carrying steam. He may be faced with one of a group of problems relating to combustion and combustion control. Among the possibilities are smoky fire, flame forms carbon, tubes soot up rapidly, can't carry load, fuel consumption too high, flame puffs out at low firing rates, flame pulsates, etc. Here he must make a diagnosis, and like every good doctor he has brought along a few instruments: "stethoscope" (draft gage), thermometer, and "metabolism tester" (orsat).

Study of the fire tells him much, even without instruments. A fire bright, almost white, burning with a roar, is bound to have too much air, especially if it is rather small compared to the dimensions of the firebox. Such a fire will have difficulty carrying heavy load. He turns up the fuel feed and reduces the draft to make the fire a mellow yellow color, perhaps even with a fringe of smoke. To make sure of his diagnosis, he should use his instruments before and after the flame adjustments.

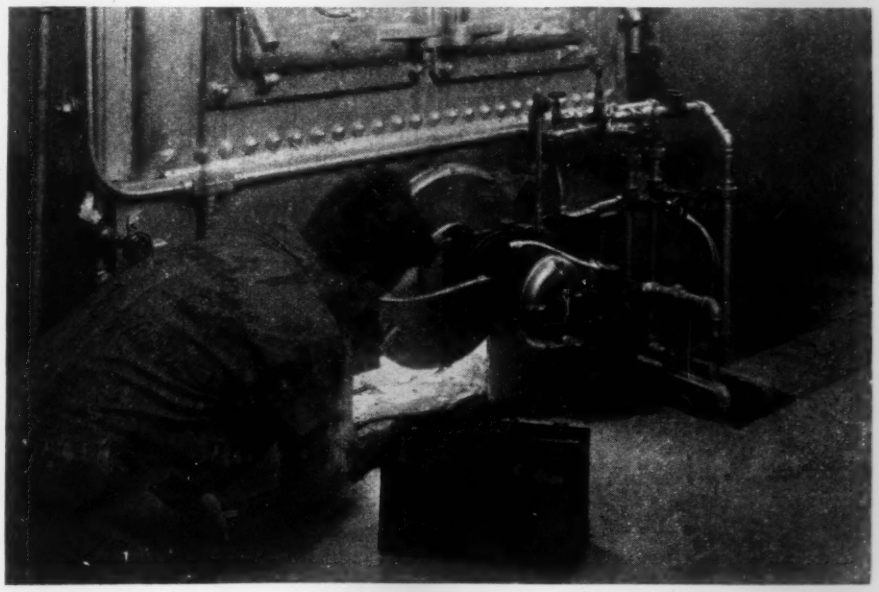
If the original fire is poorly formed, almost shapeless, burning without a characteristic rhythmic resonance, he suspects too little draft, and if his gage shows poor draft in the firebox but good draft in the uptake (a high draft loss through the boiler), he suspects sooted tubes.

A roaring, billowing, smoky fire, completely filling the firebox and maybe a little more, means too much fuel turned on, beyond the capacity of the installation to handle.

A fire alternately leaving the nozzle, burning formlessly near the back wall, then returning to the nozzle, indicates too much primary air, too little fuel, or both. A jerky fire—pulsating, dying down, and resuming—could be the result of a leaky suction line, with air entering in minute bubbles, most likely from a loose packing gland around a valve stem, swivel joint, or strainer gasket. A fire that starts out normal in size and then gradually dies down may indicate a defective pressure regulator, a partially blocked suction line, or a dirty strainer.

Carbon formation around the firing cone, on the refractory surrounding the throat or firing port, results from impingement of oil spray. On new installations, probably the flare of the refractory away from the firing port is not sharp enough, and some of it will have to be cut away. If the oil is particularly heavy or viscous, the atomizer is throwing slugs of unatomized oil tangentially, through the air stream. Where preheating is used, a higher temperature will help to thin the oil and improve the atomization effectiveness. An air nozzle with vanes substituted for a plain nozzle, or a nozzle with steeper angles to the vanes substituted for one with shallow angled vanes, induces greater turbulence of air and oil and can help. Some nozzles have adjustable air vanes, permitting the service man to try various angles of the vanes.

Carbon on the floor of the firebox means the burner was set too close to the floor. There is nothing much the service man can do about it, except to try an air nozzle that might straighten the flame, reducing the flare. Carbon on the back wall is the result of impingement; the remedy is to shorten the flame, which may be possible by simply reducing the oil feed, but if the load calls for the same firing rate, then



Today's burners require versatility on the part of the service man

the fire must be made thicker or bushier, which allows burning the same amount of oil with a shorter flame, and can be brought about by using the proper vanes in the air nozzle.

Adjusting the Air and Oil

The two preceding paragraphs refer of course to the maximum fire, the flame that results from the combustion controller being at maximum position. In that position, the burner may be throwing a good fire, and as the firing rate automatically diminishes as the variable fire controller begins to close, the fire characteristic should remain substantially unaltered except as to size. But if the lower firing rates produce an improper fire —either too smoky, or too bright, or jerky, or even a snuff out—then of course the air and oil are not being altered in synchronism.

Just what to do depends entirely upon the type of controller in service, but generally speaking there are separate adjustments for air and oil, and these must be brought into balance so that at any position of the variable fire controller, the two are fed in the same proportion. One common fault is the controller being set for too wide a range between maximum and minimum fire; often by reducing the length of the crank arm or leverage of the system, the spread between high and low fires is reduced, alleviating the problem of synchronizing air and oil over a very wide range.

* * * * * *

We leave the service man with his instruments, adjusting the fire so as to make sure the combustion efficiency is high throughout the firing range. He wants the customer to realize the greatest benefit from his boiler plant—the most steam with the least fuel. And while he is so occupied, let us review the things that the plant engineer or maintenance man can and should do for himself, because the service man is a busy person and should not be called more often than absolutely necessary.

Lubrication is an important fundamental and usually presents no problem to plant personnel. Oil burners do not need any more attention for lubrication than any other machine, and as with other machinery, lubrication should be performed according to the instructions of the burner manufacturer. A point worth mentioning is that the level of lubricant in a reservoir should be verified manually, even though a sight glass purports to reveal the level.

After lubrication comes cleanliness. Among the items requiring periodic cleaning might be listed the helix coils of stack switches, atomizing cups and air nozzles, glass lenses of photocell or flame eye apparatus, igniters and pilot safeguards, strainers, boiler tubes. Combustion safeguards should be periodically tested for functioning: an opaque shield placed between flame and photocell to test for relay response, the gas shutoff to test pilot safeguards; the oil shutoff to test lockout timing. Draft controllers should be checked for ee bearings and swivels. Packi on valves and pumps should b x- amined, packing nuts kept ti

At least once a day the at er and air nozzles should be exa ed cleaned if necessary, verified be free of nicks, burrs, indenta ns. At the same time, while the b er is swung open, the firing ior should be examined and v ied free of carbon deposit. The es- sure and vacuum gages are ed on the equipment for a pu ose; any sudden or abrupt change s ld be reported. The fuel supply in the storage tank should not be al ed to run low; to drop below a quarter of a tank is not desirable. Electrical equipment should be kept free of dust and grime, and protected from water and dampness.

Preventive maintenance is the best kind of service for industrial oil burners.

SATISFYING 'JOB CUSTOMERS' IS NO. 1 INDUSTRY TASK

The problem of satisfying America's "job customers," as distinguished from the problem of satisfying "product customers," is the most urgent issue facing American industry, according to Virgil B. Day, counsel for the employee relations division of the General Electric Co., at the Air Conditioning and Refrigerating Machinery Association conference at Hot Springs, Va., recently. Mr. Day recommended the application of orthodox marketing techniques to the problem of furnishing job satisfaction as the surest means of preserving the American system of free competitive enterprise.

Mr. Day reviewed G. E.'s employee relations programs, which won the American Heritage Foundation's award as the best program of its type in American industry for the past year. A thorough and exhaustive market research job to find out what employees wanted in their jobs came first, he said. It was found that employees wanted nine elements in their jobs: good pay, good working conditions, good bosses, job security, fair promotion practices, respectful treatment, full information, belief in their jobs, and job satisfaction. More than anything else, they appeared to want that feeling of dignity that comes in being considered a "job customer."

"Our ultimate objective," Mr. Day said, "is for the company to have—and deserve to have—employees at all levels whose abilities and attitudes will result in their: (1) coming to work regularly, promptly and in an eager, or agreeable frame of mind; (2) faithfully and ungrudgingly exercising their full skill, care, and reasonable effort on work properly assigned, supervised, and paid for; and (3) feeling that they have accomplished something worthwhile in association with fair and appreciative management fellow-workers, with a feeling of satisfaction that will make them want to return next day."

PURE AIR DEMANDED IN INDUSTRIAL AREAS

"The present-day dwellers in industrial communities are seeking ways and means to secure cleaner air with the same fervor that they use to demand pure water and milk," H. B. Lammers, director of engineering of the Coal Producers Committee for Smoke Abatement, recently told the West Virginia section of the American Society of Mechanical Engineers.

"Proper educational programs on smoke abatement are necessary and should be carried out at the 'plant operation level'," he said. "This should assist in overcoming the smoke made by carelessness."

Fixed horizontal louvers combat direct sun impingement on the glass of Prudential's new western home office building recently completed in Los Angeles

Single and Double Duct Systems Condition Prudential's Building

RALPH E. PHILLIPS, consulting mechanical and electrical engineer, and LOUIS H. WAGENBRENNER, chief mechanical engineer, describe the heating and air conditioning of the big new western home office building of the Prudential Insurance Co. of America in Los Angeles. The owner's business procedure requires huge open floor areas, heavy internal light and people loads, and extreme glass areas—indicating complete air conditioning. How the necessary flexibility was achieved is discussed in detail

THE PRUDENTIAL Insurance Co. of America recently completed in Los Angeles its western home office building, which controls the company's operations in 11 western states and Hawaii, including sales, service and investments. The building is of modern design with horizontal spandrels and continuous glass panels. To combat direct sun impingement on the glass, and thereby reduce the air conditioning load, fixed horizontal continuous louvers extending the length of the building were provided.

Mechanical Equipment Rooms on Third Floor

The building is on a site which, due to the very unusual soil conditions, made it inadvisable to excavate below grade for a basement. This condition, plus the fact that the entire ground floor and parts of the second and third floors were assigned to store rentals, necessitated the location of the mechanical and electrical equipment rooms on the third floor.

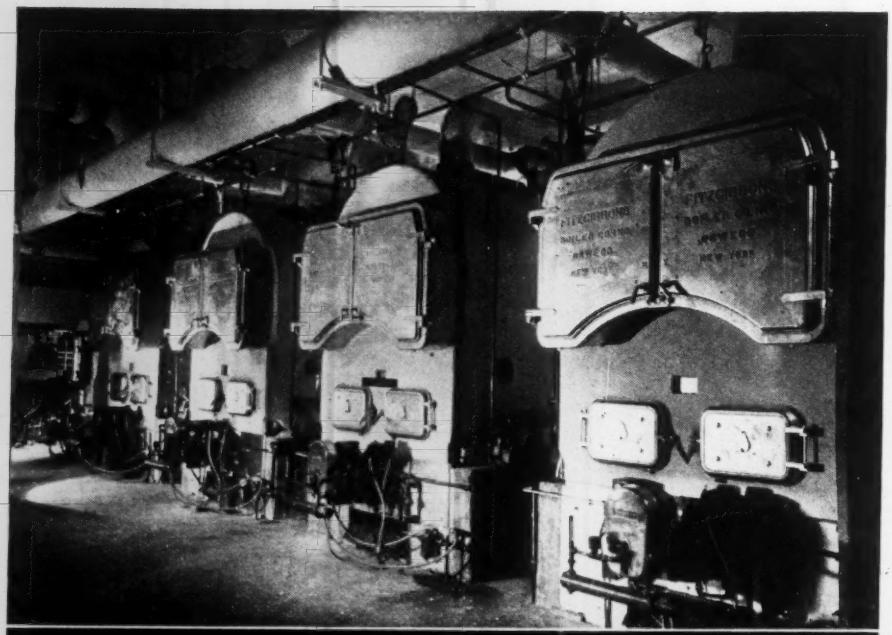
The owner's business procedure requires large open floor areas to accommodate large numbers of employees, and high intensity fluorescent lighting. In analyzing this type of structure—huge open floor areas, heavy internal light loads, heavy people load, extreme glass exposures—it was concluded that the building required complete air conditioning throughout the year.

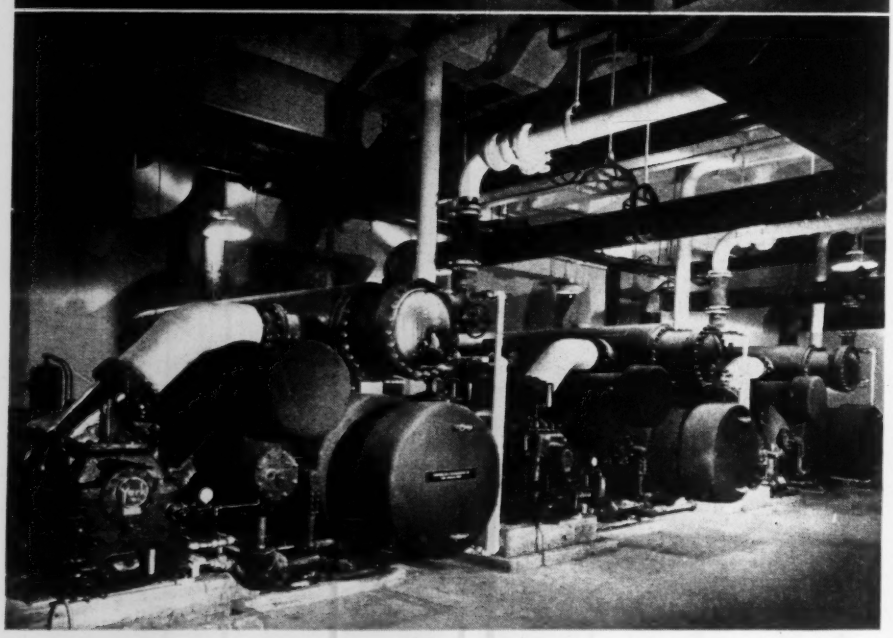
Due to the Los Angeles climate, it is possible during the spring and fall months to maintain comfortable condition by the use of 100 percent outdoor air. It was therefore decided to provide a minimum of eight changes per hour which would provide good ventilation at all times. Since the building is being heated and cooled by air, it was decided to eliminate all direct radiation.

It was also concluded that the building required zoned single duct systems whereby areas adjacent to each exposure would be separately controlled from areas adjacent to opposite exposures. In general, each floor has approximately five zones. This also simplifies the duct systems, as the air quantities for each floor are large and it was possible to run smaller sized ducts due to the number of zones.

For service and utility, the center block of the building was designed so that all elevators, toilets, and utility shafts are in this area.

The 10th floor was assigned to the executive offices. Due to the





number of offices, and the different occupancies in each office, it was decided to run a double duct system for this floor with individual temperature control for each office.

The single duct systems run back to their respective supply systems where hot and cold plenums on the discharge side of the fan and coils and automatic mixing dampers maintain the desired zone temperatures.

The double duct system consists of one duct distributing cold air and the other distributing hot air with automatic mixing dampers on each branch. This permits hot or cold air or a mixture to be distributed to each office as required to maintain the desired room temperature.

Building Divided Into Several Systems

In the final analysis the building was divided into the following air conditioning systems:

1) The second floor system supplies conditioned air to the recreation and dining room areas. It is furnished with 100 percent outside air, with exhaust taken through the kitchen area by means of a kitchen exhaust system. Since the amount of conditioned supply air available is inadequate to fulfill the requirements of the kitchen exhaust system, an additional fan was provided to supply air to storage areas adjacent to the kitchen.

2) Another system supplies 100 percent outside conditioned air to the employee health service department, which is also on the second floor, with 80 percent of the air supplied exhausted to atmosphere.

3) The third floor supply system, also 100 percent outside air, delivers conditioned air to the area. Exhaust air from this system is used as supply air for the equipment and maintenance departments.

4) The fourth to ninth floors inclusive are divided into three sys-

Top: Four boilers provide heating steam, with a fifth of smaller size for domestic hot water during the non-heating months. Center: There are three chilled water pumps and three condenser water pumps. Bottom: The central refrigeration plant for air conditioning comprises three 300 hp centrifugal compressors, with automatic load control from full load to 25 percent

tems, one for the fourth and fifth floors, one for the sixth and seventh floors and one for the eighth and ninth floors. A common exhaust fan, which handles 75 percent of the supply air, is provided for all three systems. The discharge of this fan is so arranged with automatic dampers that the air may be discharged into any of the supply systems for recirculation or wasted to atmosphere. This enables a 75 percent recirculation job during extreme weather conditions or 100 percent outside air may be supplied on mild days, without building up the excessive pressures that would be encountered had some sort of a gravity relief system been installed.

5) The 10th floor system, supplying conditioned air to the executive offices, was designed for 25 percent outdoor air and 75 percent return air.

6) There are also seven systems supplying air to Ohrbach's department store, which occupies the ground, second, and third floors in the east half of the building. These systems were designed for 25 percent outdoor air and 75 percent return air.

The above described systems handle approximately 373,000 cfm supply air and 180,000 cfm exhaust air. All fans are motor driven, with motors varying in size from 1/6 to 30 hp, with a total motor load of approximately 200 hp.

Generally, all air is supplied by means of ceiling diffusing type outlets with returns located at each end and in the center, with the aim of distributing the supply air as evenly as possible.

The refrigeration plant supplies chilled water to the entire Prudential area and the department store. It consists of three 300 hp centrifugal compressors using "Freon 11" refrigerant and having a capacity of 333 tons each. The compressors are provided with automatic load control from full load to 25 percent full load. Starting and stopping of each machine is by manual control.

The water coolers and condensers are of the shell and tube type. Condensing water is cooled by means of an induced draft cooling tower on the pent house floor. The tower is completely surrounded by walls to provide a pleasing architectural appearance. Three chilled water pumps and three condenser water pumps—a pair for each refrigerating unit—are provided for water circulation.

The heating plant consists of four low pressure, firebox, portable, steel boilers having a capacity of 18,220 sq ft EDR each. In addition, a fifth boiler of smaller size is provided for operation during non-heating months to furnish steam for domestic hot water only. The boilers are fired by means of fully automatic rotary type combination gas and oil burners. At the present time, the small boiler is being fired with gas and the large boilers with No. 5 oil. Steam is supplied to the heating coils and hot water storage heaters at approximately 2 psi gage with condensate being returned by means of a vacuum return system. The boiler plant supplies steam to the entire building, including the smaller stores and the department store.

The architect for this project is Wurdeman and Becket, the general contractor Wm. Simpson Construction Co., and the air conditioning contractor Western Air and Refrigeration, Inc. Ralph E. Phillips is the consulting mechanical and electrical engineer.

APPROVES NEW SPEC FOR STAINLESS PIPE

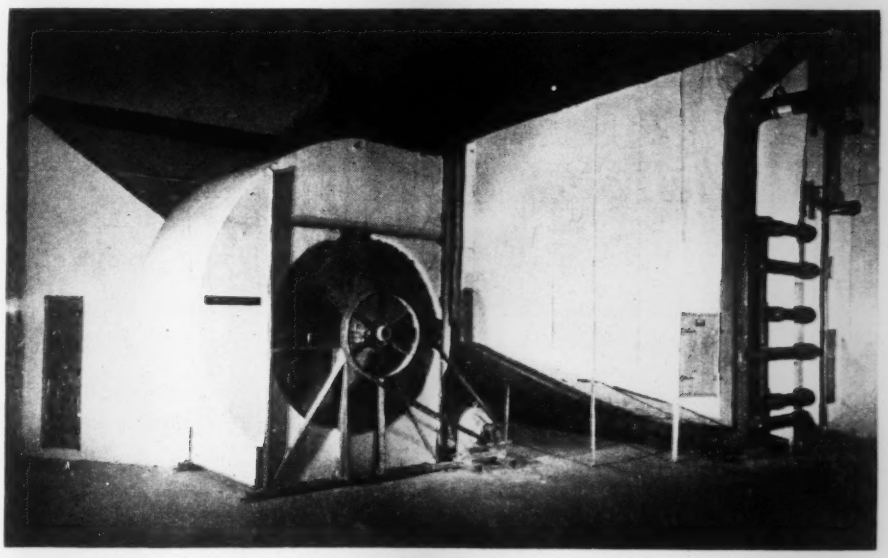
The administrative committee on standards of the American Society for Testing Materials has approved an important new specification for austenitic stainless steel pipe (A 312). This specification has been under development for many months in committee A-1 on steel, through the joint committee on stainless tubing specifications which is sponsored jointly with committee A-1 by committee A-10 on iron-chromium, iron-chromium-nickel, and related alloys. It is intended as a general guide for the purchase of austenitic steel pipe and to serve as a basis for agreement where certain details may not be specifically covered. There are five grades of material involving both seamless and welded pipe which is intended for high temperature and general corrosive service.

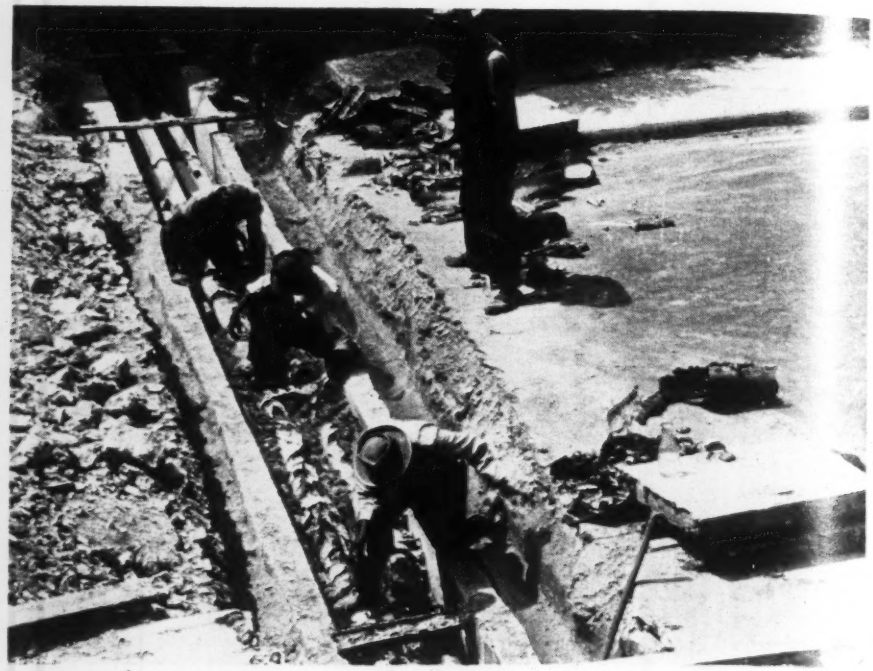
The five grades of material involve chromium-nickel (TP 304), chromium-nickel-titanium (TP 321), chromium-nickel-columbium (TP 347), chromium-nickel-molybdenum (TP 316), and chromium-nickel-molybdenum (TP 317). Maximum carbon runs 0.08, percent manganese 2.00, phosphorous and sulfur 0.030 respectively, with silicon maximum 0.75 percent. Nickel ranges from 8.0 to 14.0 percent, with chromium content going from 16.0 to 20.0 percent.

The minimum tensile requirements are 75,000 psi, with a yield point minimum of 30,000 psi. The longitudinal elongation in 2 in. is 35 percent, and transverse 25 percent.

With the establishment of this stainless pipe tentative, it is expected that committee A-1 will make certain rearrangement of its high temperature specifications so that the stainless grades can all be concentrated in this new document A 312.

The air systems handle a total of some 373,000 cfm of supply air and 180,000 cfm of exhaust air, the total motor load being approximately 200 hp. This shows one of the fan systems in the pent house fan room





Roof slabs removed showing insulation failure

Re-Insulating Underground Piping

ROBERT LEVY, of Lanier and Levy, Inc., consulting engineers, Washington, D. C., describes a method of re-insulating underground heated piping which is being widely applied. The particular case referred to is a large housing development with a central hot water heating system

A PRACTICAL method of re-insulating underground heated piping with insulating concrete has been carried out at the Roberts Park housing development in Norfolk, Va.

On this project of about 25 buildings, erected in 1942, hot water for both heating and domestic requirements is furnished from a central source. The insulated supply and return pipes were run underground in a concrete box type conduit.

It was evident early in 1948 that a loss in efficiency was seriously affecting the supply of hot water to the many housing units; it was felt that the insulation was either gone or not functioning properly, and it was decided to open up a section for inspection. The insulation had deteriorated extensively in many locations and had completely disintegrated at other points, showing that alternate water saturation and drying out had accomplished its worst.

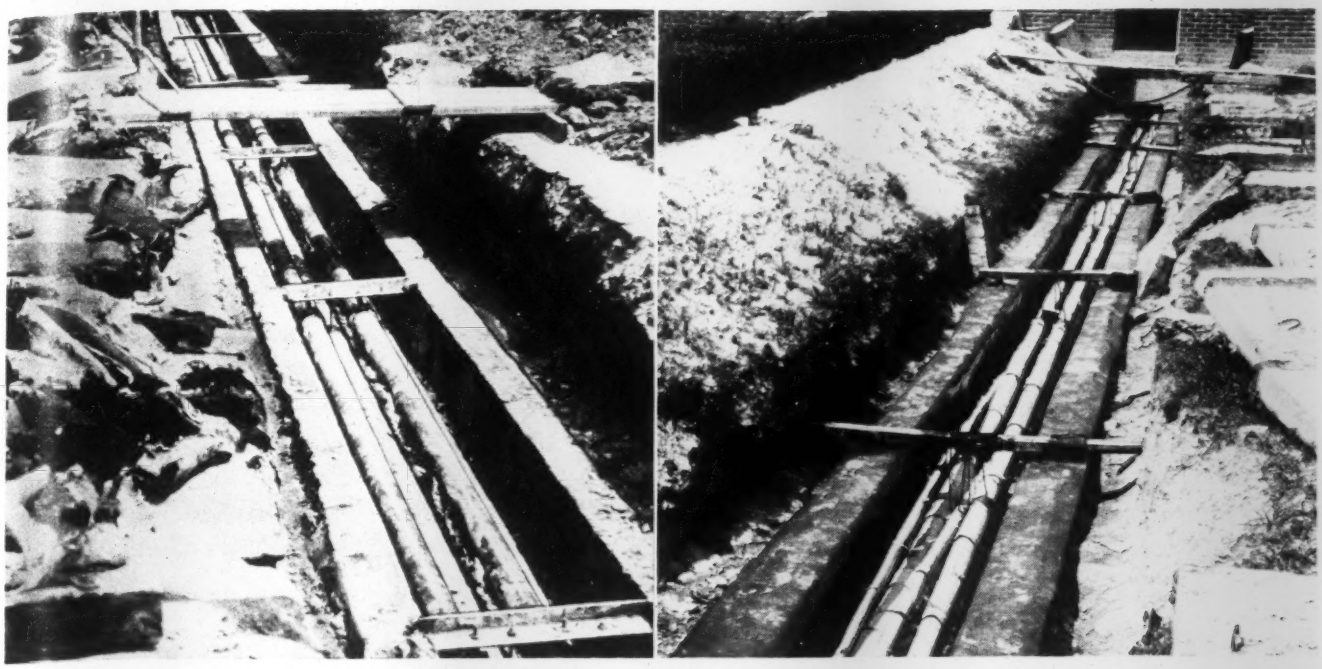
In addition, corrosion at the metal to metal contact points between the pipe and the hangers indicated the possible existence of electric currents or other elements of corrosion.

Insulating concrete was selected for the reclamation work as a likely material to provide the permanent insulation desired. By filling the existing box conduit with a solid pour of water repellent insulation, it was hoped that the possibility of moisture entering and saturating the insulation would be eliminated. As the pipes are continuously supported and aligned in the concrete insulation (without any metal to metal support points) and because this material is also a good insulator against the transmission of electric currents, it was expected that the corrosive action would be controlled also.

An excavation was opened down to the top of the existing concrete box conduit and the precast roof slabs were removed. All pipe covering remaining was cut away and the box cleaned out. The original pipe hangers and supports were removed and any pipe showing corrosive action approaching failure was replaced. Temporary support for the pipes was provided by placing timbers across the top of the concrete box and hanging the pipes to these crosspieces with wire.

Work Procedure Employed

A membrane composed of a heavy saturated felt was next mopped in place with hot pitch to the inside surface of the original box. The top ends were left loose so that they could later—after the insulating concrete had been poured—be carried over the top, completing an envelope around the insulation. This membrane is to insure a thorough curing for the insulating concrete and to give additional waterproofing protection. Next, a parting medium of corrugated paper was ap-



Left—Closeup showing original pipe supports. Right—Waterproof membrane in place, pipes wrapped and ready for insulation

plied to the pipes to keep the cement from adhering to the metal and restraining the free movement of these pipes within the monolithic mass. The job was then ready for the insulating concrete.

A standard mix of water repellent insulating concrete was poured into the box, filling it solid to the top. At building walls and at manholes, the insulating concrete was carried flush with the inside surface. As soon as the insulating concrete had set enough to resist indentation, usually the day following a pour, the wires temporarily supporting the piping were cut away and the membrane completed over the insulating concrete.

The precast roof slabs removed from the original box and not broken up were replaced. As the insulating concrete has sufficient strength to support the backfill and traffic loads that might be imposed upon the conduit, broken slabs were not rebuilt.

This reclamation project was started around the first of August 1948 and the 3000 lineal feet of conduit involved was back ready for use in six weeks.

The Norfolk redevelopment and housing authority, Lawrence Cox, executive secretary, are operators of this project. Robert Levy, of Lanier and Levy, Inc., consulting engineers, Washington, D. C., was the mechanical engineer on the reclamation work, and the insulation was installed by the Insulating Concrete Corp., Washington, D. C.

Left—Solid fill of insulating concrete. Right—Re-insulation complete and ready for backfill (Photos courtesy Zonolite Co.)

SIZING the Piping for Steam Supply and Condensate Return

R. G. LUBINSKY and M. J. WILLIAMS, manager of the fan and heating coil sales department and manager of the plan engineering department, respectively, The Trane Co., La Crosse, Wis., explained in their article in the November HPAC how to figure steam supply and condensate return pipe sizes for higher pressure systems. The table for 50 psi gage pressure steam was used in their examples. To complete the discussion, tables for steam at other pressures are published this month.

SUCCESS OR failure of a carefully designed steam piping system often hinges on the correct sizing of the supply and condensate return piping. The fact that this seemingly minor factor is often underestimated is apparent when the number of jobs that are noisy, develop air binding and water hammer, or just don't heat properly, are recalled. The great majority of these malfunctions can be traced to improper pipe sizing.

This trouble arises frequently because of the lack of information on correct pipe sizing and the philosophy of letting the other fellow do it until it gets so far down the line that the piping suffers and the whole job sours. Actually, pipe sizing is not difficult, nor does it require an extensive engineering background. However, there are a number of points to be remembered.

First of all, the determination of correct pipe sizes for a given steam load depends on three principal factors:

1) The initial pressure and the total pressure drop which may be allowed between the source of supply and the unit farthest removed from the boiler. The initial steam

Steam pipe capacity, lb per hr—5 psi steam
(Steam and condensate flowing in same direction)

Pipe size, in.	Pressure drop, psi per 100 ft of pipe length				
	1/8	1/4	1/2	3/4	1
1	24	31	44	54	62
1 1/4	52	68	97	120	140
1 1/2	81	100	150	180	210
2	160	210	300	370	430
2 1/2	270	350	500	610	710
3	490	650	920	1.130	1.300
3 1/2	730	970	1.370	1.680	1.940
4	1.040	1.370	1.940	2.380	2.750
5	1.930	2.540	3.600	4.410	5.090
6	3.160	4.170	5.910	7.250	8.360
8	6.590	8.680	12.310	15.090	17.400
10	12.020	15.840	22.460	27.530	31.760
12	19.290	25.420	36.050	44.190	50.970

Steam pipe capacity, lb per hr—15 psi steam
(Steam and condensate flowing in same direction)

Pipe size, in.	Pressure drop, psi per 100 ft of pipe length					
	1/8	1/4	1/2	3/4	1	2
1	27	38	53	65	76	110
1 1/4	59	83	120	140	160	250
1 1/2	91	130	180	220	260	380
2	180	260	370	450	520	740
2 1/2	300	430	600	740	860	1.210
3	560	790	1.110	1.360	1.570	2.220
3 1/2	830	1.180	1.660	2.040	2.350	3.320
4	1.180	1.660	2.350	2.880	3.330	4.700
5	2.180	3.080	4.350	5.330	6.160	8.700
6	3.580	5.060	7.150	8.750	10.120	14.290
8	7.450	10.530	14.880	18.220	21.060	29.740
10	13.600	19.220	27.150	33.250	38.430	54.250
12	21.830	30.840	43.570	53.370	61.690	87.100

Steam pipe capacity, lb per hr—25 psi steam
(Steam and condensate flowing in same direction)

Pipe size, in.	Pressure drop, psi per 100 ft of pipe length					
	1/8	1/4	1/2	3/4	1	2
3/4	15	21	30	37	43	60
1	30	43	61	75	86	122
1 1/4	67	95	130	160	190	260
1 1/2	100	140	210	250	290	410
2	210	300	420	510	590	840
2 1/2	340	490	690	850	980	1.380
3	630	900	1.270	1.550	1.800	2.540
3 1/2	950	1.340	1.900	2.320	2.690	3.790
4	1.340	1.900	2.680	3.280	3.800	5.360
5	2.480	3.510	4.970	6.080	7.040	9.920
6	4.070	5.770	8.160	9.980	11.550	16.290
8	8.480	12.010	16.980	20.780	24.050	33.910
10	15.480	21.910	30.990	37.920	43.890	61.880
12	24.850	35.170	49.740	60.860	70.440	99.310

Steam pipe capacity, lb per hr—50 psi steam
(Steam and condensate flowing in same direction)

Pipe size, in.	Pressure drop, psi per 100 ft of pipe length					
	1/4	1/2	3/4	1	2	5
3/4	27	38	47	54	76	120
1	54	77	94	110	150	240
1 1/4	120	170	210	240	340	530
1 1/2	180	260	320	370	520	830
2	370	530	650	750	1.060	1.680
2 1/2	620	870	1.070	1.240	1.750	2.760
3	1.130	1.600	1.960	2.270	3.200	5.060
3 1/2	1.690	2.390	2.930	3.390	4.780	7.560
4	2.390	3.380	4.150	4.790	6.760	10.690
5	4.420	6.250	7.670	8.860	12.560	19.780
6	7.260	10.260	12.590	14.540	20.520	32.470
8	15.120	21.360	26.210	30.280	42.720	67.580
10	27.580	38.980	47.840	55.250	77.960	123.300
12	44.270	62.560	76.780	88.680	125.100	197.900

Steam pipe capacity, lb per hr—100 psi steam
(Steam and condensate flowing in same direction)

Pipe size, in.	Pressure drop, psi per 100 ft of pipe length				
	½	¾	1	2	5
¾	50	61	70	99	160
1	100	120	140	200	320
1¼	220	270	310	440	690
1½	340	420	480	680	1,080
2	690	850	980	1,390	2,190
2½	1,140	1,400	1,620	2,280	3,610
3	2,090	2,560	2,960	4,180	6,610
3½	3,120	3,830	4,420	6,250	9,870
4	4,420	5,420	6,260	8,840	13,960
5	8,170	10,020	11,580	16,350	25,840
6	13,420	16,450	19,020	26,840	42,410
8	27,930	34,250	39,580	55,870	88,280
10	50,970	62,500	72,230	101,900	161,100
12	81,810	100,300	115,900	163,600	258,500

Steam pipe capacity, lb per hr—150 psi steam
(Steam and condensate flowing in same direction)

Pipe size, in.	Pressure drop, psi per 100 ft of pipe length				
	½	¾	1	2	5
¾	59	73	84	120	190
1	120	150	170	240	370
1¼	260	320	370	520	830
1½	400	500	570	810	1,280
2	820	1,010	1,170	1,650	2,610
2½	1,360	1,660	1,920	2,720	4,300
3	2,480	3,050	3,520	5,090	7,870
3½	3,710	4,550	5,260	7,430	11,760
4	5,250	6,440	7,440	10,510	16,630
5	9,720	11,920	13,770	19,450	30,780
6	15,950	19,560	22,600	31,930	50,520
8	33,210	40,720	47,050	66,470	105,100
10	60,590	74,310	85,860	121,300	191,900
12	97,250	119,260	137,800	194,700	308,000

Steam pipe capacity, lb per hr—200 psi steam
(Steam and condensate flowing in same direction)

Pipe size, in.	Pressure drop, psi per 100 ft of pipe length				
	½	¾	1	2	5
¾	67	82	95	130	210
1	130	160	190	270	430
1¼	300	360	420	600	940
1½	460	570	650	920	1,460
2	940	1,150	1,330	1,870	2,970
2½	1,550	1,890	2,190	3,080	4,880
3	2,830	3,470	4,000	5,650	8,950
3½	4,230	5,180	5,980	8,430	13,360
4	5,980	7,320	8,460	11,930	18,900
5	11,060	13,550	15,650	22,080	34,970
6	18,150	22,240	25,690	36,240	57,410
8	37,790	46,310	53,480	75,440	119,500
10	68,960	84,500	97,590	137,600	218,000

Steam pipe capacity, lb per hr—250 psi steam
(Steam and condensate flowing in same direction)

Pipe size, in.	Pressure drop, psi per 100 ft of pipe length				
	½	¾	1	2	5
¾	74	91	105	150	230
1	150	180	210	300	470
1¼	330	400	470	660	1,160
1½	510	620	720	1,020	1,620
2	1,040	1,270	1,470	2,070	3,280
2½	1,710	2,090	2,410	3,410	5,400
3	3,130	3,820	4,420	6,250	9,880
3½	4,670	5,710	6,610	9,340	14,770
4	6,600	8,080	9,340	13,210	20,890
5	12,220	14,950	17,290	24,440	38,650
6	20,060	24,540	28,380	40,100	63,400
8	41,750	51,100	59,100	83,500	132,000

Gravity, vacuum, and high pressure return pipe capacity, lb per hr

Pipe size, in.	Low pressure		High pressure return, steam pressure in psi					
	Gravity return	Vacuum return	25	50	100	150	200	250
¾			236	312	419	560	682	1,074
1	200	350	474	617	823	1,120	1,385	2,150
1¼	400	600	989	1,306	1,755	2,330	2,880	4,450
1½	700	950	1,610	2,126	2,850	3,800	4,710	7,350
2	1,200	2,000	3,280	4,325	5,785	7,700	9,550	14,875
2½	1,650	3,350	5,400	7,160	9,640	12,800	15,850	24,600
3	2,600	5,350	9,890	13,070	17,550	23,300	28,850	34,750
3½	3,800	8,000	14,700	19,400	25,900	34,500	42,700	51,350
4	6,500	11,000	20,800	27,360	36,550	49,200	60,900	73,350
5	10,400	19,400	38,850	52,925	70,000	91,500	114,500	127,600
6	18,000	31,000	61,200	83,700	112,700	150,000	185,500	223,100

Equivalent length of pipe to be added for fittings

Size of pipe, in.	Length in feet to be added to run				
	Standard elbow	Side outlet tee	Gate valve (*)	Globe valve (*)	Angle valve (*)
½	1.3	3	0.3	14	7
¾	1.8	4	0.4	18	10
1	2.2	5	0.5	23	12
1¼	3.0	6	0.6	29	15
1½	3.5	7	0.8	34	18
2	4.3	8	1.0	46	22
2½	5.0	11	1.1	54	27
3	6.5	13	1.4	66	34
3½	8.0	15	1.6	80	40
4	9.0	18	1.9	92	45
5	11.0	22	2.2	112	56
6	13.0	27	2.8	136	67
8	17.0	35	3.7	180	92
10	21.0	45	4.6	230	112
12	27.0	53	5.5	270	132

* Valve in full open position.

pressure in most cases is the gage pressure at the boiler. Then the allowable pressure drop is the difference between the desired operating pressure at the supply side of the unit farthest removed and that at the boiler. Normally, in a system using 25 psi or higher, the allowable pressure drop should not exceed 30 percent of the initial pressure.

2) The maximum velocity of steam allowable for quiet and dependable operation of the system, taking into consideration the direction of the condensate flow. This factor is important in single pipe systems where steam and condensate flow in the opposite directions, in which case the velocity is limited to eliminate objectionable noise built up between the counterflowing water and steam. Velocity, in this case, should not exceed 1200 fpm. Where steam and condensate flow in the same direction, velocity of the steam may be increased considerably. In considering high pressure systems with large capacity heat transfer equipment installed, the factor of velocity is important primarily from the standpoint of economy in pipe sizes. A higher velocity means a reduction in pipe size, and consequent reduction in cost—but it also means a higher pressure drop. A balance must be obtained between the size of the pipe and capacity of the farthest removed unit so that the overall cost will be the most economical and yet maintain satisfactory performance of the system.

Pressure drops used in determining capacities of return piping tabulated above

System	Pressure drop, psi per 100 ft of equivalent length
Vacuum	¼
25	½
50	⅝
100	¾
150	1
200	1¼
250	1½

3) The equivalent length of the run from the boiler or source of steam supply to the farthest unit. The equivalent length of pipe in a steam system is the actual length of run plus the resistance set up by pipe, fittings, and valves expressed in feet of straight pipe. Since the equivalent length of pipe is generally not known at the outset, it is a common and practical method in figuring high pressure systems to assume a total equivalent length of 1½ times the measured length and then check this assumption after the pipes are sized.

Effect of Entrance On Flow of Fluids

AFTER READING the article by Herman Vetter on basic principles of piping in the December issue, I would like to make some comments on his explanation of the effect of the entrance form on the entrance flow.

In effect, I do not see any appreciable difference between a steel ball and a column of water in relation to the rebound. A solid column of water is diverted horizontally, after striking a surface, only if the column itself prevents the water from being deflected at the same angle at which it strikes the surface; that is, if the surface is practically at right angles with the column. But this is a secondary question and is brought forth only because it seems to me a too simple method of explanation of the vena contracta.

I do not think that the sketches of Fig. 8 in Mr. Vetter's article are correct because they do not show what actually happens in a tank or where we have a contraction of the flow section. In a tank discharging from the bottom or from the side, not only the fluid in front of the outlet is in motion. All the fluid surrounding the outlet is interested in the phenomenon and what happens is shown in the left part of my sketch. The contraction of the flow is caused by the velocity of the water moving in directions other than vertical. This water is represented in the sketch by the horizontal and slanted arrows, and—according to the law of inertia—tends to continue its motion in the direction of the arrows, hindering the flow of the vertically flowing water and being hindered by the latter. As a result, the flow reaches a configuration of equilibrium which is independent of the pressure existing at the outlet level, and which depends only on the configuration of the outlet and the ratio A_2/A_1 of the sections after and before the entrance.

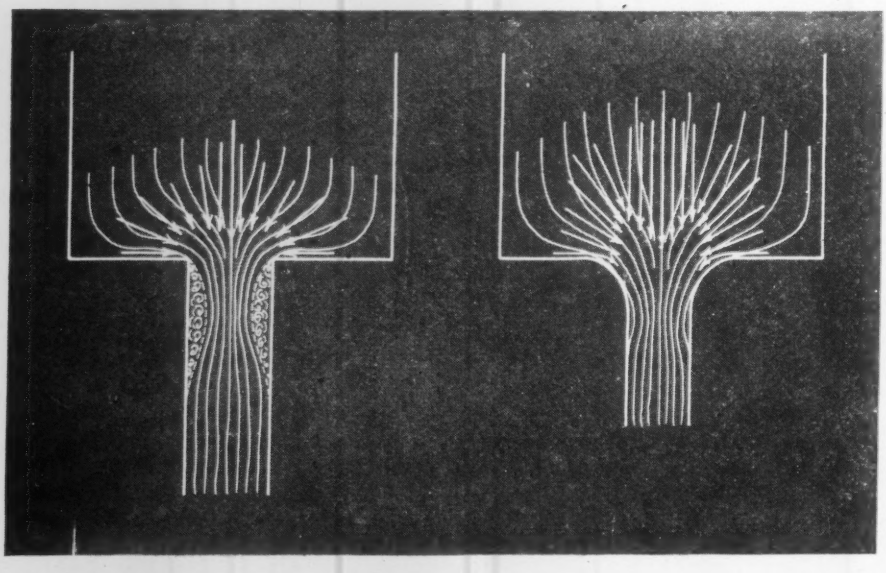
This configuration is approximately that shown by Mr. [illegible] and for this form of outlet the area of the core through which the water can pass is 0.6 of the pipe section for the ratio A_2/A_1 equal to less than 0.01, and increases as this ratio increases according to the following table:

	Sharp-edged outlet					
A_2/A_1	0.01	0.10	0.20	0.40	0.60	1.00
Core area	0.60	0.61	0.62	0.65	0.70	1.00

For the bell-mouth entrance we have the same phenomenon but the water flowing vertically in the direction of the outlet is a greater quantity and has more time to divert the water flowing horizontally or in slanted directions and makes it follow the entrance surface. When the outlet section reaches the pipe section the water at the outside of the column has a slant direction and so the effect is less than with a sharp-edged outlet; nevertheless we have a contraction that with well rounded outlets can be only 1 percent of the pipe section. For the similarity of the two phenomena the assertion that in a bell-mouth entrance we have the greatest concentration of forces (pressure) on the wall surface is not correct because in this type of entrance we have only materially eliminated part of the turbulent space, and so the distribution of pressures is the same that we had with a sharp-edged entrance.

Except for these comments, I found the article of Mr. Vetter very interesting and very clear.—MARCELLO GIOMI, Albuquerque.

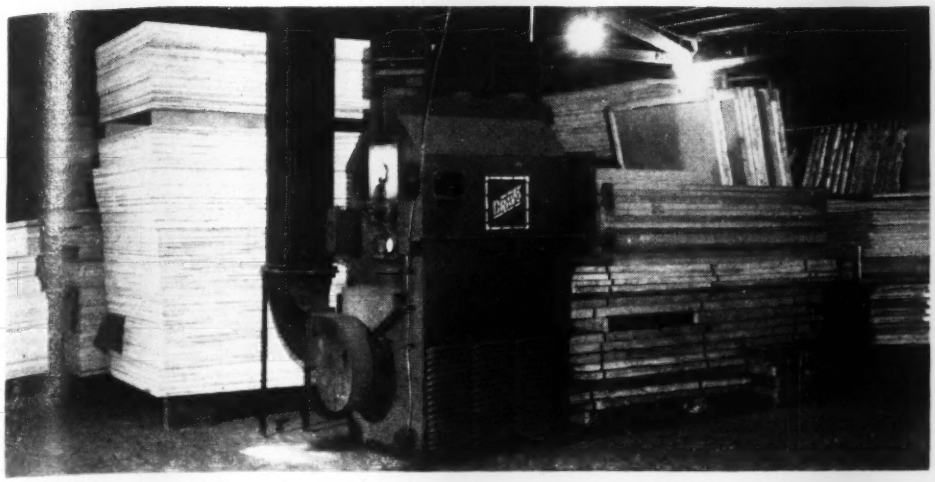
Effect of entrance form on entrance flow, as sketched by Mr. Giomi



URGES UNIFORMITY IN BUILDING CODES

Progress in the modernization of local building codes can be speeded up if the sponsors of various model codes will strive for a maximum of uniformity in their code provisions, Charles M. Mortensen, executive secretary of the Producers' Council, national organization of building products manufacturers, said last month.

"Code revision made unprecedented progress in 1948, but many hundreds of communities still are clinging to obsolete codes which prevent the use of new materials and methods, and thus unnecessarily increase the cost of constructing buildings," he said.



One of the two 500,000 Btu per hr direct fired heaters which improve working conditions in a warehouse

Direct Fired Heaters Serve PLYWOOD WAREHOUSE

THE problem of heating a building in which plywood is stored or handled is complicated by the danger of damaging the product by excessive drying. This is especially true where lumber is tiered high, because of the tendency of the warmest air to rise toward the roof. Yet, certain areas of such buildings do require heat to establish comfortable working temperatures for employees during the winter.

At the Chicago distributing warehouse of the United States Plywood Corp., this problem has been solved by the use of two space heaters that, in effect, build a "wall" of warm air and provide satisfactory temperatures in the areas around the receiving and shipping departments along one side of the brick structure. Before the heaters were installed, frigid blasts of cold air through open doorways during the winter months chilled the building to such an extent that it frequently became necessary for employees to stop work and shut the doors.

The building has a large area of uninterrupted floor space where plywood is received and stored for packing and shipping at later dates. The wood truss roof is 20 ft high at its peak. Thus, the problem of concentrating heat only in the receiving and shipping departments was difficult. Construction of a partition to divide the storage area from the other departments would have hampered the movement of material.

Use of the two direct fired heaters has resulted in "protection" of workmen in front of six 8 ft by 8 ft doorways that are open almost continuously the year 'round while receiving and shipping operations are in progress.

The heaters have an output of 500,000 Btu per hr each and are fired by No. 3 fuel oil. The principle on which they operate permits their use for spot heating with only a minimum amount of warm air being dissipated to other areas. The discharge nozzles on the heaters are directed at the door openings about 20 ft away and warm air is blown out at a velocity of 2000 fpm, slightly above head height.

The heaters pull cold air from floor level into their bases through louvered openings. The flow of air is from all directions and at low velocity which tends to minimize drafts. The cold air first passes over staggered banks of economizer tubes and then sweeps a stainless steel combustion chamber that permits transfer of heat energy, from flame to air, within a matter of seconds. Each heater can handle 5500 cfm.

Fred Kohnke, shop foreman, stated that workmen unloading plywood from railroad cars on the siding adjacent to the building were able to work in light weight clothing during the cold weather last winter because the heaters established a "comfort zone" in that area. In fact, he said, the interiors of boxcars were warmed as hot air was blown into them through the open doors.

The truck loading dock is enclosed but unheated. However, sufficient warm air is discharged from the heater nearest that area to keep it comfortable.

Operated by a pushbutton, the heaters are turned on during the winter at about 6 a. m. and shut off at 5 p. m. Because they produce heat quickly after a cold start, they do not have to be kept running during the night. Mr. Kohnke reported that the heaters were easy to install because they required only three connections, one each for the fuel line, electric wiring and vent stack. They also can be used during the summer for ventilation by operating only the fans.

Eliminating Fire Hazards in Windowless Buildings

By Howard C. Murphy, Consulting Engineer and Member, HPAC's Board of Consulting and Contributing Editors

THE WINDOWLESS type of construction has many desirable aspects, as well as certain disadvantages—some of which may be eliminated by careful engineering.

Temperature, humidity, air cleanliness, and lighting can be arranged to suit the occupants. Troublesome window condensation is eliminated and outside dust and noise are barred.

Improved methods of air sterilization have been developed utilizing ultraviolet lamps, chemical vapors, and ultrasonic radiation which can readily be applied to windowless buildings. This offers the only protection we can now visualize against possible attack in bacterial warfare, the bacterial count as well as the possibility of cross infection from airborne organisms in such spaces being materially lower than in untreated areas. The consequent lowering in the incidence of certain airborne respiratory disorders might well justify the cost of installation even in peacetime.

However, the multistoried windowless building, unless carefully engineered, may present definite problems in fire fighting. There are no windows through which to carry hose lines; smoke and heated gasses which are ordinarily vented through windows are trapped in the building, adding possible hazards to life and materials.

In the ordinary type of building construction, arrangements are usually made to shut down the ventilating or air conditioning fans at the alarm of fire. Heat and smoke are ventilated by opening windows, skylights, and other outlets.

The committee on air conditioning of the National Fire Protection Association has had under consideration for some time recommendations covering the use of the ventilation or air conditioning systems to eliminate possible smoke and panic hazards.

At their last annual meeting, the following was added to the Standards of the National Board of Fire Underwriters for the Installation of Air Conditioning, Warm Air Heating, Air Cooling and Ventilating Systems (copies of this pamphlet, NBFU No. 90, may be secured from the National Board of Fire Underwriters, 85 John St., New York 7; 222 W. Adams St., Chicago 6; or Merchants Exchange Bldg., San Francisco):

"103. It is recommended that in buildings, especially of the windowless type, where the panic hazard is pronounced, means be provided for mechanically removing smoke. Such smoke removal systems may incorporate such portions of air conditioning, heating, ventilating or exhaust systems as may be adapted to the purpose. It is important that the system be arranged to keep smoke away from exitways.

"In the absence of more definite data, it is recommended that the smoke exhaust equipment have a capacity approximating a 10 minute air change.

* * *

"No attic, basement or concealed space in a building shall be used as an integral part of a duct system unless it conforms to all the requirements for ducts.

"125.(b). Public exit halls in hotels, hospitals, institutions and similar occupancies and in multifamily houses shall not be used as plenums."

The Associated Factory Mutual Fire Insurance Cos., 184 High St., Boston 10, has prepared a free bulletin (No. 8.24) on this subject of interest to engineers. It states:

"Special exhaust systems for the removal of smoke would not be justified in most instances. Smoke can be removed with reasonable effectiveness, however, by arranging the air conditioning system to vent smoke outdoors. This generally can be accomplished by arranging air supply louvers so that a maximum amount of fresh air will be [illegible] into the ventilating system a[illegible] discharged into the fire area, thu[illegible] reing smoke out through hinge[illegible] louvers, which are usually insta[illegible]d in the outside walls of air cond[illegible]oned buildings and which open a[illegible]ght increase of air pressure wit[illegible] the building. This may increa[illegible] the rate of burning somewhat [illegible] introducing currents of fresh a[illegible] but the effect would not be much [illegible]fferent than if windows and doo[illegible]s were opened to vent smoke. Ven[illegible]g is necessary if fire is to be [illegible]ught effectively.

* * *

"In systems operating continuously without shutdown periods [illegible] with controls arranged to start the fan manually, it is reasonably safe to omit fire dampers in fresh air distribution ducts, and depend upon the positive movement of air through these ducts in the opposite direction to which fire, heat and smoke would normally travel.

The bulletin also contains sketches for the suggested arrangement of air conditioning equipment in windowless buildings.

* * *

Editor's note—In commenting on this subject, George W. Booth, chief engineer of the National Board of Fire Underwriters, New York City, says:

"It is our feeling that any automatic operation of fans to exhaust smoke should be considered proper only in buildings that are protected with automatic sprinklers. It seems generally accepted that any introduction of fresh air for the purpose of removing smoke will intensify the fire, and unless prompt means are provided for extinguishing such a fire, it is sure to result in increased fire damage, with resulting increase in hazard to life. Where automatic means are provided for thus exhausting smoke, we think it is reasonable to have automatic sprinkler protection to automatically control the fire.

"In the National Building Code recommended by the National Board of Fire Underwriters, 1949 edition, the subject of windowless buildings is covered by a requirement (in section 1702-1) that all buildings which do not have a specified number and arrangement of doors or windows be protected with automatic sprinklers."

An exhaust intake slot around the ceiling trim of the wellway on each floor has a tapered opening varying from $1\frac{1}{2}$ to $1\frac{3}{4}$ in. wide to assure equal suction at all points. Velocity through the slot can be regulated by positioning a sliding plate to reduce the intake slot width

Store Demonstrates Smoke Exhaust System

A NEW electronically controlled exhaust system for preventing the chimneylike spread of smoke and fire gases through a burning or smoke filled building was demonstrated at the Sage-Allen department store, Hartford, Conn., recently. Clouds of smoke from chemical bombs filled the basement selling floor of the store. In less than 10 sec, the system detected the smoke and began drawing it into collection ducts which carried it out of the building. Without the system the smoke might have spread to other floors through the moving stairway opening in the center of the store.

The installation is the first to combine electronic smoke detection with an exhaust system for fire protection purposes, according to William Haine, vice president of the store. The technique uses a smoke detector and exhaust apparatus, and was installed to supplement the store's existing sprinkler system for fighting fires because, says Mr. Haine, "smoke spreads faster than fire and consequently constitutes the bigger threat to a completely sprinklered building.

"It is commonly recognized that the superheated air and toxic gases which accompany fire are its principal killing agents," the store official pointed out. "However, not only does smoke kill directly and damage property, but perhaps most dangerous, it can cause panic."

To provide a controlled path for smoke removal, the system utilizes collection ducts surrounding the stairwell on each floor. These ducts lead to an exhaust fan on the roof which can draw out 32,000 cfm of air. Nearby on the roof is a louvered pent house directly over the stairwell. It is through the louvers that fresh air is drawn down into the building.

Each floor has an independent detection unit. Through six tiny inlets on each floor, called accumulators, continuous samples of air are drawn by a small fan to the basement. There a composite sample for each floor is formed continuously 24 hr a day and passed under the surveillance of an electric eye.

Electric Eye Analyzes Air

When there is even a slight amount of smoke present, the electric eye—even while it is stopping the electric stairways and ringing an alarm in the boiler room, activates the exhaust system. It starts the exhaust fan, opens the collection duct damper on the floor where smoke is detected, closes all other floor dampers, and opens the fresh air intake. All this takes place simultaneously, Mr. Haine said.

As a result, smoke is pulled into the collection ducts on the floor where it originates, and is removed from the building. The gentle 14 mph smoke movement produced by the fan creates a partial vacuum in the stairwell, and cool, fresh, replacement air rushes down from the roof and helps to push smoke into the collection ducts. This downdraft constitutes an invisible air wall that prevents smoke from passing floor to floor.

Stopping the electric stairways converts them into conventional stairways so that both "up" and "down" units can be used for escape purposes, if necessary.

The six air samples from each floor are drawn into an individual 8 ft long by $2\frac{1}{2}$ in. tube in the basement. A lamp behind a lens at one end of the tube projects a light beam down the tube to a sensitive electric eye at the other end.

Smoke in the sampling air decreases the light reaching the photocell, causing its electric output to drop. When it falls below a safety point, sensitive relays activate, or "alarm," the exhaust system. The detection equipment is similar to that used on ships, in fur vaults, and other land installations.

Ethan Allen Dennison, New York, was the architect for the installation; Dwight D. Kimball, with Erik B. J. Roos, associate, New York, was the consulting engineer, and the Southern New England Construction Co., Hartford, was the general contractor.

BOGOTA STORE AIR CONDITIONED

Housed in a new $1 million windowless, completely air conditioned structure, the Valdiri department store in Bogota, Columbia, now occupies one of the most modern store buildings in South America, according to officials of Carrier Corp.

Comfort air conditioning is unusual in Bogota, which is situated 9000 ft above sea level, and generally cool in summer. Its use resulted from the determination of the owner to incorporate in his new building every modern facility available for store operation. The air conditioning system not only provides comfort for customers, but filters dust from the air, thus keeping displays fresh and clean. It also provides heating and ventilation in winter.

The building has four large product display windows—the largest in the city—on the street side, but no windows of the conventional type for the admission of light and air. Advanced selling techniques are employed by the store.

Air Conditioning Aids Biological Research

I HAVE read with considerable interest E. E. Herbacek's article in the January HPAC on the air conditioning installation at our nutrition laboratories.

It seems to us that the article as written would be of interest primarily to engineers, and we believe it would be a splendid idea to add to this strictly technical article on air conditioning, a discussion of some of the problems that this installation overcame as far as the biological research laboratory is concerned.

It would seem to us that the biological research part of this installation should be stressed so that engineers will be alerted when presented with a problem with similar earmarks. The nutrition laboratories are not an integral part of product control work but are primarily for nutrition research. Secondly, we think the important problems that have been solved by this installation would be found to apply generally, and with only minor modifications, to animal laboratories—whether the animals are rats, dogs, guinea pigs, mice, rabbits, monkeys or any other species that biologists use in medical and other biological research work.

Our primary difficulties with air conditioning in previous nutrition laboratories were chiefly in two directions: (1) one large air diffuser was used instead of multiple air diffusers in each animal laboratory, and air circulation from this single source created too great air movement for the tolerance of animals susceptible to respiratory infections; (2) fresh air supply was not sufficiently purified as regards noxious gases found generally in a factory or warehouse district.

With our system as installed, we have achieved the following, which in our opinion meets the requirements of biologists for proper air conditioning:

1) Drafts have been adequately reduced.

2) Noxious gases are satisfactorily eliminated.

3) Temperature and humidity controls are adequate to make possible the conduct of experiments on a year 'round basis in an essentially uniform environment (this is important where such factors as growth are involved as experimental criteria.)

4) Animal odors are sufficiently eliminated by the volume and rate of air flow and by the air filtering devices so that offices can be serviced from the same incoming air duct system as the animal laboratories without spread of animal odors to the office quarters (important especially where economy of space arrangement requires non-laboratory people to be housed in close association with animal quarters.)

5) Special care was given to outside wall insulation. It is poor economy of space when the animal cages must be located from 5 to 6 ft in from the outside walls.—DR. L. E. BOOHER, biological research dept., General Mills, Inc., Minneapolis.

CONTINUOUS PROCESS MAKES ICE

A new continuous process for ice making that generates cakes without brine, ice cans, or labor, was described last month at the annual meeting of the American Society of Mechanical Engineers by John R. Watt, assistant professor of mechanical engineering at the University of Texas. In this method, a machine using direct expansion freezing cylinders extrudes hard white ice in continuous columns suitable for automatic severing into cakes.

"The 'incremental film' principle allows ice formation of approximately 10 lb per sq ft of freezing surface per hr at 5 F suction pressure, or about 30 times greate han ice plant practice," Mr. Watt ted. "The pilot commercial 1 to na- machine has one moving part a re- quires floor space 3 ft squa It generates cakes 12 by 15 in. any length. Operating costs ar low. The ice is suitable for railw and truck icing, fisheries, dairies rms and air conditioning."

SUBMITS DATA ON COLUMN RADIATION

ON THE QUESTION of the onth pages in the December HPA information was requested by a ead- er on ratings for old column radi- ation.

I submit herewith data alo the lines requested, which I hav used with success for many years in my own heating work.—G.D.H.

Ratings of column radiators submitted by "G.D.H."

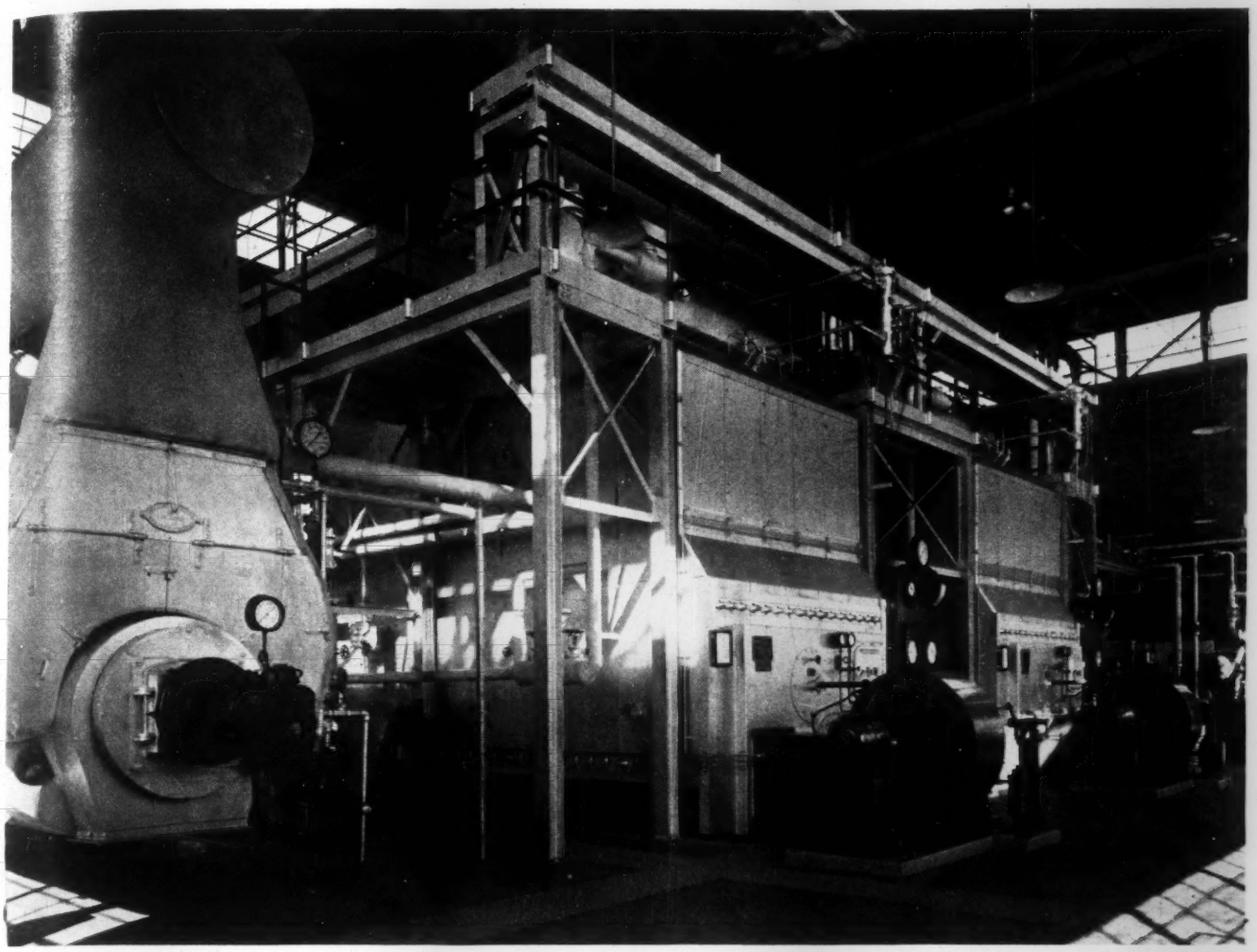
Pattern (No. of tubes)	Approx. Depth, in.	Catalog Height, in.	Radiation per section, sq ft
One column	4½	38	3
		32	2½
		26	2
		23	1-2-3
		20	1½
Two column	7½	45	5
		38	4
		32	3-1-3
		26	2-2-3
		23	2-1-3
		20	2
		15	1½
Three column	9	45	6
		38	5
		32	4½
		26	3¾
		22	3
		18	2¼
Four column	10½	45	10
		38	8
		32	6½
		26	5
		22	4
		18	3

Ratings of wall radiators as given by "G.D.H."

Approximate Overall Dimensions, in.	Radiation per section, sq ft
13 x 17	5
13 x 22	7
13 x 29	9

Ratings of horizontal pipe coils on a vertical wall, in square feet of radiation per linear foot of coil (*not* linear foot of pipe), as used by "G.D.H."

Pipe size	1 in.	1¼ in.	1½ in.
One row	0.55	0.67	0.77
Two rows	1.05	1.30	1.45
Four rows	1.83	2.27	2.57
Six rows	2.36	2.92	3.30
Eight rows	2.71	3.32	3.78
Ten rows	3.05	3.78	4.25
Twelve rows	3.38	4.20	4.73



Steam and other principal utility services are carried from the boiler house to the various buildings in reinforced concrete pipe trenches, the steel plate covers of which serve as snowfree paths during the winter months

Convenience Features Laboratory Piping

Services Originating at Widely Separated Points Enter Each Room in Compact Standard Groupings

SINCLAIR Refining Co.'s new research and development laboratories at Harvey, Ill., illustrate a trend toward adoption of institutional campus lines in the layout of industrial research centers. Nine buildings with a total of 215,000 sq ft of floor space have been grouped in one landscaped 20 acre block so that the individual units can be doubled or trebled in size without encroaching on each other or on undeveloped sections of the 38 acre site.

The layout includes two large interconnected, three story, air conditioned buildings for administrative and general research activities, a tall six section pilot plant building, a 46,000 sq ft engine laboratory, and smaller structures for distillation and catalyst activity tests, other research functions, and various services.

The basic structural layout of the welded steel framework in the three story, U shaped main laboratory made it possible to enclose all columns in the corridor walls. The 60-odd individual laboratories, arranged across the base of the "U" and in the two wings, are thus free of obstructions, to permit maximum flexibility in the work areas.

This arrangement of working areas also permitted installation of the required laboratory utility mains in a pipe tunnel around most of the perimeter of the building. In the inside of the "U" (where offices, storerooms, electrical control centers, employee facilities, and an elevator are located) only limited utilities are required and the tunnel was omitted.

Utility branch risers are carried in the space between the brick outer walls and the tile inner walls. Removable steel panels at strategic points in the outer walls of each room provide ready access to the lines. The services include illuminating gas, vacuum, compressed air, refrigeration, process steam, hot and cold water, deionized water, and electric current. Although

these services originate at many widely separated points in the plant, they enter each room in compact standard groupings which simplify the layout of laboratory equipment. These can be connected with a minimum of piping and wiring and entirely without overhead obstructions. Throughbolts were spaced at regular intervals in the laboratory walls for use in the installation of equipment.

A centrifugal refrigerating compressor of 600 ton total capacity, which serves air conditioning systems in both the administration building and the main laboratory, is located on the first floor of the laboratory, along with the deionized water generator and the domestic hot water tank for the building.

The supply of air from the general air conditioning system enters the individual rooms through grilles in window sills. Makeup air for the exhaust system is supplied through wall outlets when the exhaust fans over the laboratory hoods are in operation.

Special safety features and devices installed throughout the building keep fire and explosion hazards to a minimum. The continuous, forced circulation of air throughout the building and the use of individually controlled exhaust fans reduce the possibility of vapors collecting in dangerous quantities. Ring-pull showers throughout the halls can be used in case of an acid accident.

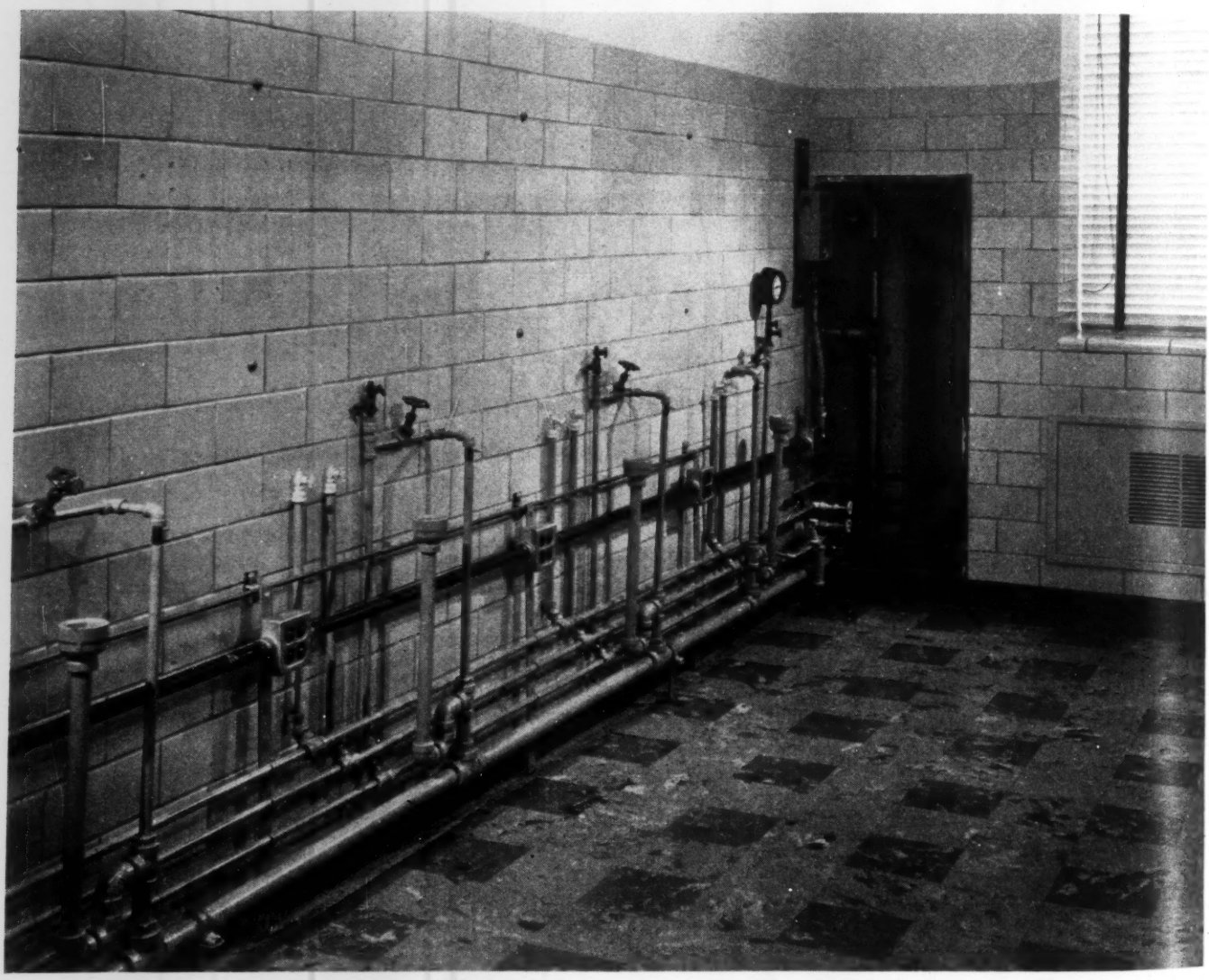
Carbon dioxide systems protect equipment and personnel in the main laboratory. The five hazard areas of the laboratory are equipped with both manual and automatic fire protection systems. Six hose and reel stations, two on each floor, are also connected to the carbon dioxide system.

Two 30,000 lb per hr oil fired boilers installed in a boiler house directly adjacent to the general laboratory shops provide heat and laboratory process steam for all of the buildings on the site, and are supplemented by a small coal-fired marine boiler which was originally installed for temporary heating during the construction period. Fuel oil tanks for the boilers are above ground, directly behind the boiler house.

Steam and the other principal utility services are carried to the various buildings in reinforced concrete pipe trenches of sufficient size to accommodate any possible expansion of the laboratory layout. These are covered with steel plates which serve as snowfree paths between the buildings in the winter months.

The Austin Co. was the engineer and builder.

Laboratory utility services run in a pipe tunnel around most of the perimeter of the main laboratory building, with branch risers carried in the space between the brick outer walls and the tile inner walls. Removable steel panels in the walls of each room provide ready access to the piping



Careful analysis should be made to determine the type of heating system to be used

How to Heat LOW RENT HOUSING

RECOMMENDATIONS for design and construction of heating systems for low rent housing projects are given in a booklet entitled Maintenance Men Look at Housing Design, published by the National Association of Housing Officials.

For central heating, it is suggested that:

1) Irrespective of the location, a careful and practical economic analysis should be made to determine the type of fuel and type of heating system to be used. This analysis should be based on practice in the community and equipment and operations based on all local and national code requirements. In housing communities with large, closely grouped apartment buildings, the central heating plant appears to be the most economical and practical system in use today.

2) Distribution mains should be equipped with adequate sectionalizing valves for shutting off small sections of the system in order to simplify and expedite repairs.

3) Smoke breeching and stacks should be sized or designed by sound engineering practices to suit boiler capacities and operating conditions. The architectural aspect of the buildings should not control either the building location or the height of stacks.

4) Extreme care should be exercised in the specifications and designs for heating systems and distribution systems. The necessity for keeping cost down is recognized but the lowest priced article is usually very expensive in the long run.

5) Circulating pumps on hot water heating systems where high static heads are required due to site topography should be installed in such a manner that the heat exchangers or boilers will be on the suction side of the pumps. This arrangement will reduce excessive pressure on these vessels.

6) Pumps should be insulated from the building structure. In addition, all supply and return lines to the pumps should be provided with flexible couplings to reduce noise and vibration. Phase protection should be provided on all polyphase motors.

7) Central heating systems should be well equipped with proved heating control systems, with simple, adequate metering and recording instruments, installed in dustproof cabinets. Shutoff valves should be provided for all radiators. It should be possible to operate all heating control valves from the boiler plant and a three valve bypass should be provided for each heating control valve.

8) Vaults for expansion joints and expansion loops on distribution mains should have a manhole at each end to provide adequate ventilation and safe working conditions. Vaults and conduits should be provided with positive drainage. Tunnels for steam and hot water distribution should be used under city or project streets. Serious consideration should be given to the use of tunnels for all distribution mains, especially where the sidewalk could be used for the top of tunnel.

9) Steam jet ash conveyor should be a vacuum type.

10) Manhole frames for coal holes should be raised at least 3 in. above the drive and should not be installed in locations where foot traffic prevails.

11) Fuel storage should be designed for a minimum of 10 days' supply during peak heating load.

12) Forced warm air convector

radiation should be discontinued. Maintenance costs are too high.

13) The practice of fitting boiler house equipment into inadequate basement spaces has made the operation and maintenance of boiler plants very difficult and expensive in some cases.

14) Boiler rooms should be of ample size, well ventilated, as free from columns as possible and should contain showers, toilets, and locker facilities.

15) Continuous flow, differential heating control systems are definitely preferred.

16) Steel coal bunkers for large plants should be lined on the inside with concrete to prevent erosion and corrosion. They should also be equipped with scales of sufficient capacity for weighing heavy truck loads of coal.

For group heating, it is stated:

1) Small group heating systems are not in general economical and should not be considered unless justified by actual operating experience of the type proposed or in operation in the same locality. If used, they should be tied together for economical summer operation. Group plants using solid fuels in many large cities are expensive to operate and maintain.

2) In projects served by group plants for space heating, hot water storage heaters should be included in the boiler room for generating domestic hot water to supply the community laundries and dwelling units. Experience has demonstrated that this method of generating domestic hot water is more economical and satisfactory than the use of an individual heater for each dwelling unit.

3) Most items included with central plants are applicable to group plants also.

As to tenant operated heating systems, it is stated that:

1) Individual tenant operated heating units in many localities appear to have lower operating costs than would be possible with any other equipment.

2) Gravity hot water systems in row houses and flats with full basements are preferred. All radiators should have shutoff valves and the system a positive drain to sewer.

3) Coal storage should provide for a minimum of 2 tons stored in durable concrete or masonry storage bins and so placed that lawns will not be cut up by servicing of bins.

4) Heating units in utility rooms are too crowded for economical maintenance and the storage of tenant's equipment in such rooms is difficult to control and presents a potential fire hazard. Storage space should be provided in a different location from that of the space heater and separated by a fireproof partition.

5) All equipment using project-supplied fuel should have a limiting or fixed maximum type of thermostat.

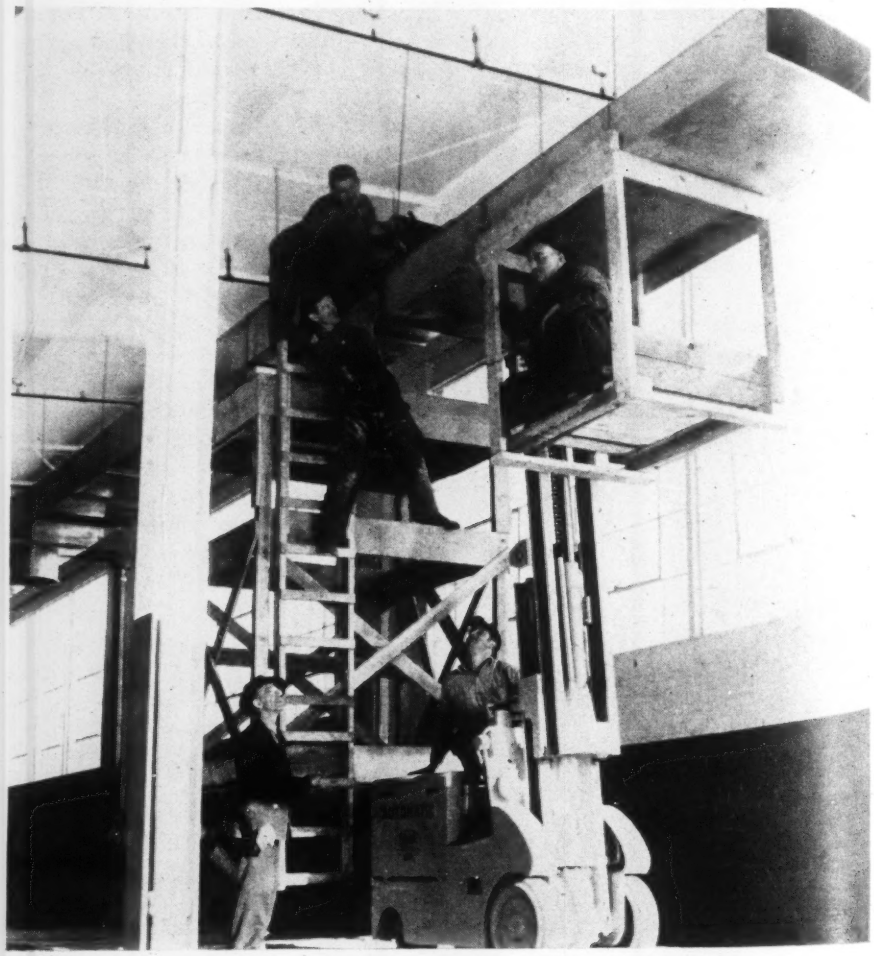
6) Forced warm air heating systems seem to be fairly satisfactory from a heating standpoint. However, the following conditions are observed: power requirements are fairly high; tenants use blow[ers] in summer; motor repairs a[nd] replacements are high in some projects; without filters, redec[orating] costs are increased; if filte[rs] are used, they should be of a cle[anable] type and so located that t[enants] can remove them and clean [them]. Some additional duct work, [espe]cially returns, is necessary [for] a more uniform distribution o[f heat]. motor and fan bearings re[quiring] lubrication once a year will [reduce] maintenance costs.

7) Chimneys must be desig[ned in] accordance with sound engin[eering] practice and not for archite[ctural] appearance. Where a coal [fired] space heater is used in conjunction with a gas fired hot water heater an adequate flue must be provided.

AUTOMATIC LIFT TRUCK AIDS DUCT ERECTION

Art Lentz, maintenance foreman (standing at left in the accompanying picture), devised a quick method of erecting the ductwork for the heating and ventilating equipment in the new hermetic compressor department at the York Corp.'s Grantley plant. Instead of building an extensive system of scaffolding he designed a movable, elevated platform which could be mounted on an automatic lift truck and the 12 tons of ductwork was up in a jiffy.

Special platform for automatic lift truck simplifies installation of ducts



More Power for Gas Compressing

Piping and equipment under one of the generator foundations—the bottom of the condenser, motor driven condensate return pump, and lube oil cooler

Piping and Other Equipment at Hastings Station Painted in Color Dynamics Plan

W. W. ARMSTRONG, engineer, power dept., Dravo Corp., Pittsburgh, describes briefly new power facilities for compressing stations of the Hope Natural Gas Co. at Hastings, W. Va. . . . The color dynamics system of painting is used, with piping, valve handwheels, etc. in "focal ivory"

To PROVIDE a dependable source of electrical power for vital compressing stations at Hastings, W. Va., the Hope Natural Gas Co. has completed installation of three new 1500 kw turbogenerators operating at 2400 volts on a three phase, 60 cycle circuit. Installation of the generators and construction of a new building for them was one of the final steps in a three year, $25 million expansion program scheduled to be completed this year, the 50th anniversary of the company.

Steam capacity at the Hastings station has been increased from 525,000 to 730,000 lb per hr by new boilers. New gas compressing equipment has been installed to replace old equipment. Previously, the station's only power supply, besides outside sources, was provided by two 500 kw turbine generators. To insure uninterrupted service and meet new added power requirements, the company decided to make the station independent from a power standpoint.

One of the problems at the station was that of water supply. Although South fork of Fishing creek passes through the property and was dammed to provide a pool, there was still a twofold problem: First, a screening house had to be provided at the creek bank to keep leaves and debris in the water from entering the condensers. Second, the creek sometimes overflows its banks and floods the area, making it necessary to waterproof the generator station up to the maximum flood stage of the creek.

The site chosen for the generator station was formerly occupied by a boiler house so the concrete foundations of the old boilers had to be blasted out before construction of the station could begin.

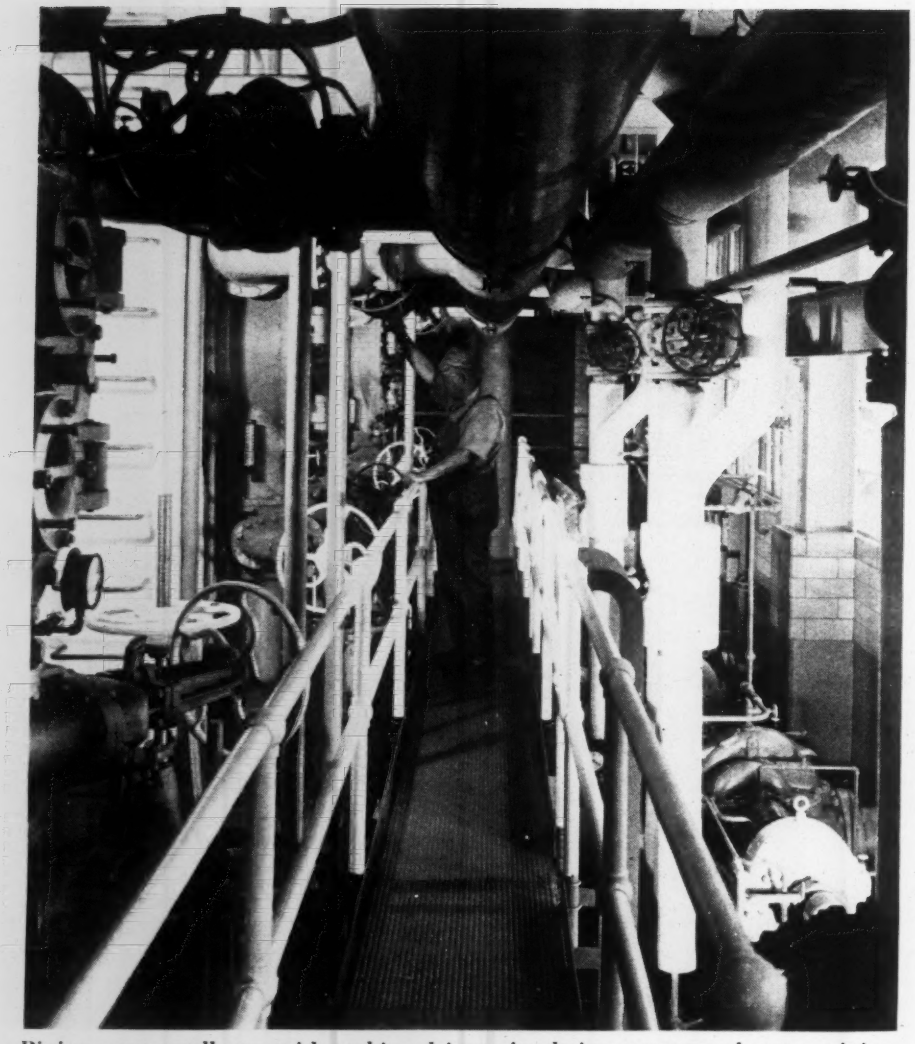
Reinforced concrete foundations for each of the three generators were built as independent structures founded on 6 in. steel pipe piles, pointed and driven to rock and filled with concrete. The pipes, capped by square steel plates, extend into the base of the foundation concrete. In all, there are 321 of the steel piles supporting the generators and building.

Steam Piped Overhead from Boiler House

The turbines for each generator are supplied with steam at 175 lb pressure piped overhead from the boiler house approximately 100 ft away. The supply line is 10 in., branch lines are 8 in., and individual feed lines for the turbines are 6 in. There is a bleeder connection on each turbine with a regulator valve to maintain 10 lb pressure in the low pressure steam system returning to the boiler house. Unit heaters for the generator station are supplied from the 10 lb system.

Metal clad switchgear units on the operating floor control the generators and exciters and contain distribution breakers for outgoing 2400 volt and 480 volt power circuits. The 480 volt power is obtained from two 1200 kva, three phase, 60 cycle, air cooled transformers in the basement.

Each of the 2500 sq ft surface condensers is supplied with water through two 10 in. risers from a 16 in. circulating water header. Circulating water pumps are 3000 gpm



Piping access walkway, with turbine driven circulating pumps and steam piping at right and ends of the condensers and circulating water piping at left

each and discharge into the header, permitting any pump to service any condenser.

12 In. Water Line for Emergency Use

The water screening house built in a sheet steel pile cofferdam is 22 ft x 28 ft with two traveling water screens each 4½ ft wide. A 36 in. concrete pipe underground carries water 62 ft to the deep well alongside the generator building where suctions for the pumps are located. For emergency use, if the creek should dry up, there is a 12 in. water line running to the Hastings plant from the Ohio river at New Martinsville, W. Va.

The generator building, 78 x 44 ft, is of rigid frame construction with brick facing and glazed tile interior up to the second floor window sills, with asbestos-cement board siding above. The roofing is of asbestos-cement board and a continuous 6 in. roof ventilator is provided. The entire structure is waterproofed up to elevation 725 ft, the level of the main entrance door. All construction joints have copper stops and bitumastic expansion filler; this is because the high water mark of the nearby creek is elevation 723 ft. Normal pool elevation is 714 ft while the natural ground line is 721½ ft.

The building is designed so that it can be extended and a fourth turbogenerator installed, if needed, at a later date. The operating floor level is at elevation 740 ft, or 17 ft above the high water level of the creek. In the basement, a sump pump has been installed to remove flood water.

Painted in "Color Dynamics" System

The entire structure has been painted in accordance with the "color dynamics system." The operating room ceiling, walls down to the tile, and sash are cascade blue; the turbine generator units a[illegible] green; the tops of the ge[illegible] foundations are tile red to [illegible] the quarry tile floor, and th[illegible] rails, steam pipes, and valve[illegible] are focal ivory. The baseme[illegible] and ceiling are ivory; the [illegible] generator foundations, cascad[illegible] equipment is vista green; [illegible] focal ivory and green, an[illegible] tile red. The exterior doo[illegible] sash are white.

An added touch is the att[illegible] landscaping around the stat[illegible]

The Hastings station is th[illegible] est in Hope's system. From [illegible] gas is pumped to Ohio, Pen[illegible] nia, New York, and other [illegible]

BIOLOGICAL PROCESSES AT LOW TEMPERATURE

Scientists are unravelling mysteries of chemical substances important to biological processes by studying them at extremely low temperatures which slow down molecular motion. A low temperature research project conducted under a grant from the American Cancer Society was described by Dr. John R. Loofbourow, professor of biophysics at Massachusetts Institute of Technology, before the 33rd annual meeting of the Optical Society of America.

New Light on Cell Growth

By reducing chemical compounds to a temperature near absolute zero, details of complex molecules hitherto unobservable can be studied by spectroscopic methods, he said. The research throws new light on cell division and growth and also on substances affecting living organisms, he said, and it therefore leads to a better understanding of the processes that take place in living systems, both in normal functioning and disease.

CHICAGO STOKER INSTALLATIONS UP

Installations of commercial and industrial sizes of underfeed stokers for the first nine months of 1948 in Chicago totalled 1213 units compared with 890 for the like period in 1947, according to a compilation prepared by the Midwest Stoker Association from permit reports issued monthly by the Chicago department of smoke inspection and abatement.

SAM LEWIS' PAGE

Informal comment on heating, piping, and air conditioning matters is given in this regular feature by Samuel R. Lewis, consulting mechanical engineer, member HPAC's board of consulting and contributing editors

Practical Pointers on Use of Heating, Conditioning Control

Mr. Lewis sheds some tears here for the "underdog" automatic temperature control subcontractor who tried to apply control in two cases where it just couldn't work. One job is the heating system for a good sized general office, the plant comprising two 10 section cast iron warm air furnaces, each section with its own gas burner and pilot flame. The other is a cooling installation for a general office, where the consulting engineer yielded to the owner's attempt to reduce the cost for a refrigerated system

I HAVE A good deal of sympathy for the underdog, running back to my own little gentle collie friend with his throat in the jaws of a big Labrador retriever who weighed twice as much as he did. The present recipient of my sympathy, however, is the "underdog" contractor who installs an attempt at automatic temperature regulation in a plant that cannot be controlled.

The poor little collie couldn't talk (of course he yelled)—but the poor subcontractor for the automatic temperature control in the following cases didn't have enough intestinal fortitude even to yell.

A consulting engineer designed a gas burning, all-indirect, heating system for a good sized general office.

He provided two 10 section cast iron warm air furnaces. The various sections each have an independent gas burner and pilot flame. A supply fan draws air in from outdoors, mixes it with a portion of recirculated air, and forces it around the furnaces and into a plenum chamber above the furnaces. From this chamber many individual air ducts run to separate rooms or zones in the office building.

In each duct there is a throttling damper responding to a thermostat in the respective zone. An outdoor thermostat attempts to open serially the 10 normally closed gas supply valves to the 10 furnace sections, heating section by section as the weather becomes colder. The indoor thermostats attempt to prevent overheating—as on the sunny side or as rooms are overcrowded—by reducing the volume of air delivered through the duct to the too-warm area. The supply fan runs at constant speed and no automatically controlled bypass damper is provided around the furnaces.

It is, of course, desirable that the furnaces be on the pressure side of the supply fan, so that air leakage will be inward through the joints in the furnaces; with the furnaces on the suction side of the fan, there might be contamination of the air by the products of combustion.

The Theory Doesn't Pan Out

The air in the plenum chamber above the furnaces theoretically will be at some optimum temperature, such as would carry enough heat to serve the coldest room or zone when the damper in the duct leading to that zone is fully open. The theory doesn't pan out, however, because unheated air passes over the furnace sections that are not burning gas, and the result is a stratified conglomeration of air in the plenum chamber, with very cool air going to some zones while very hot air goes to other zones. If several of the zone dampers are throttled or

closed, the air pressure in the plenum chamber increases, due to the constant speed fan, and air roars and whistles through the dampers that remain open.

The underdog in this important project, a contractor for automatic temperature control, was afraid to refuse to tackle the job or to criticize its design. The building was built and the plant was completed. The yelling was done by the occupants and it eclipsed the calls for help from the little collie in the jaws of the big Labrador.

The engineer who designed the plant spent all the compensation he received from the owner (and more) in trying to make the work acceptable. The automatic regulation contractor also contributed more than he expected to be paid—all because he failed to refuse to undertake an impracticable contract.

Yields to Owner's Attempt to Cut Corners

In another case, a competent and reputable consulting engineer who designed an acceptable steam heating plant for a large general office yielded to the owner's attempt to reduce the investment cost for a refrigerated cooling system.

The plant as installed is a failure and has caused the contractor for automatic temperature control more pain than that inflicted on the collie by the Labrador. And all because no protest was lodged against an incompetent design.

In this case, the original owner now plays the harp, the friend who designed the cooling system is missing, and so the plant has become a friendless orphan.

The supply fan can pull back some of the air for recirculation, but there is no automatic or even ostensible manual control of the relation between outside air and recirculated air supply. There is no exhaust fan nor is there even a hole in the return air duct to permit escape to outdoors of the excess air when increasing volumes of outside air are taken in.

The supply fan discharges through a steam heating coil without any face or bypass dampers, then through a direct expansion evaporator; then, at one temperature only, it blows through long ducts to many rooms in a building that has both west and north and east and south exposures.

No Zoning of Air Temperature

There is no means of zoning the air delivery temperature except by a gentleman on a ladder, who may play with a damper in each of 20 ceiling grilles—and who, of course, never does so play! He is too busy, and anyway he can't adjust an invisible damper that may require readjustment several times each day as the sun looks in from a different direction.

A crowning glory of this job is an attempt to use the steam heating coils, designed for winter, as pre-cooling coils with city water ...ning through them in summer on ...way to the too-small condenser ...the half-big-enough refrigerati... ...om-pressor.

Occasionally, the janitor ... ...omes confused as to the very com... ...ated valve manipulation and flo... ...the rather distant boilers and ...oiler room with city water sent by ...verse flow through the winter ste... ...sup-ply piping.

I own no stock in any ... ...cern that furnishes equipment ...at I specify. If I did own stock ... the underdog automatic temp...ature regulation concern that took ... the control contracts in these t... very ill jobs that I am presently ...build-ing, I think I'd sell it!

Pipe Line Progress

During the next few years, about 50,000 miles of pipe line will be laid for transmission of natural gas and petroleum crudes and products, according to the Industrial Bulletin of Arthur D. Little, Inc. The largest proportion, or about 19,000 miles of pipe, will be for natural gas within the United States; the next largest use will be for foreign crudes, using slightly more pipe than domestic crudes. The recent annual pipe line review of the Oil and Gas Journal features this high level of activity, as well as some technical innovations.

Natural gas transmission in the United States has become more important with a gradual shift in our fuel economy over the past several years. Because of its improving competitive position, use of natural gas has expanded much more rapidly than that of either oil or coal. Peak demand cannot yet be met in winter, despite transmission of more natural gas than ever before. Many eastern utility companies hope to mix their manufactured gas with natural gas, with its higher heat value, to serve more customers through existing mains, now taxed to the limit.

Almost 70,000 miles of pipe are now used to carry natural gas. Greatest demand is in the northeast, where population is greatest, while the natural gas producing areas are the midwest, south, and southwest. The Big and Little Inch pipe lines, converted for natural gas, now have a capacity for 500 million cubic feet a day, with an expansion program expected to raise capacity to over 900 million cubic feet. A recently authorized pipe line from Mercedes, Texas, to New York City will have a daily capacity of about 325 million cubic feet. It will be the largest single pipe line project ever undertaken, with over 1800 miles of pipe. Another integrated program for more lines to connect the southwest and south with the northeast, including New England, is expected to have a daily capacity of over a billion cubic feet.

Although lines for crude oil and petroleum products do not account for as much mileage as natural gas they are important to our fuel economy. Approximately 5000 miles of domestic crude lines are planned with another 1000 miles for products lines; about 2500 miles are now under construction. Much of this will connect west coast refineries with large oil producing centers in the southwest, since no lines exist there today. Other projects will supplement existing lines to refineries in the oil centers, and increase the crude oil capacity flowing to the refining areas of the midwest and east.

Because the United States is now a net oil importing country, and the middle east has over half the world's total reserves, a gigantic effort is underway to make these vast oil supplies accessible to world markets. Projects in South America and Canada also total considerable pipe line mileage.

QUESTION OF THE MONTH

YOU ARE invited to submit a heating, piping, or air conditioning question for publication here. You are also invited to submit answers to previously-published questions from others. Those published are paid for at regular rates. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

Readers Flooding Us With Ratings for Old Radiators

A REQUEST from "R.L.B." for data on ratings of old style radiators published in our December issue has met with an unusual and much-appreciated response from HPAC's readers, for a great deal of material has been forwarded in reply to this question. Some of it is published here. Do you want more data on ratings? If the demand is large, we'll try to find space in future issues for as much of the data as possible

INFORMATION on ratings of old style, column type, cast iron radiators—or some method of determining their ratings—was requested by "R.L.B.", member of a firm of architects and engineers, in a question published in the December HPAC. "In remodelling work," he wrote, "we frequently come in contact with many variations of such radiators, for which we need to know the square foot radiation rating, and we are hard put to determine this."

Readers of HPAC have been most generous in sending in answers to this question. Some of the figures submitted are published here, and it is hoped to publish more of the data if space is available in future issues.—ED.

HAS SCRAP BOOK OF OLD RATINGS

REFERRING TO the request of "R.L.B." in the December issue for information about old style radiators, many years ago I started a scrap book in which I posted pictures of all the radiators I could find together with their ratings for the same purpose that he wants them.

This book covers cast iron, pressed steel, and pipe radiators, and all the old style indirect cast iron radiators of large and small manufacturers. It goes back to the old "Whittier" and "Reed" radiators, the "Bundy" loop radiator, and the "Walworth" and "Nason" pipe radiators.

It consists of approximately 100 pages, 6 x 9½ in. I would be glad to have photostat copies of any or all these pages made for "R.L.B.", or any other reader, giving pictures of the radiators, manufacturer's name, and ratings, if he will tell me what he wants.

Generally speaking, however, the single column radiators which look like narrow two column radiators were rated by most manufacturers at 3 sq ft for 38 in., 2½ sq ft for 32 in., 2 sq ft for 26 in., 1⅔ sq ft for 23 in., and 1½ sq ft for 20 in. Some few manufacturers rated them slightly higher.

Most two column radiators were rated at 5 sq ft for 45 in., 4 sq ft for 38 in., 3⅓ sq ft for 32 in., 2⅔ sq ft for 26 in., 2⅓ sq ft for 23 in., and 2 sq ft for 20 in.

Most three column radiators were rated 6 sq ft for 45 in, 5 sq ft for 38 in., 4½ sq ft for 32 in., 3¾ sq ft for 26 in., 3 sq ft for 22 in., and 2¼ sq ft for 18 in. "Richmond," "Princess" and "Imperial," "Corinth," and "Minnesota" radiators are the exceptions. They were rated somewhat higher.

Four column radiators were rated 10 sq ft for 45 in., 8 sq ft for 38 in., 6½ sq ft for 32 in., 5 sq ft for 26 in., 4 sq ft for 22 in., and 3 sq ft for 18 in. A few were rated slightly lower.

Five and six column and flue type radiators varied so widely, no averages can be arrived at. The make must be known to get the ratings.

Wall radiators also varied so

much in style and shape that an average rating would be hard to determine. Of the conventional type, those approximately 27 to 29 in. by 13 to 14 in. were rated at 9 sq ft; 22 in. by 14 in. at 7 sq ft; and 14 in. by 14 in., 5 sq ft.

These are all taken from my collection, which I must admit is probably far from complete. If any reader has data on very old radiators (such as the old steel or cast iron panels which were approximately 3 ft x 4 ft) I would appreciate hearing from him.—R.T.K.

MULTIPLIER FACTORS SUPPLEMENT RATINGS

IN RESPONSE to the request from "R.L.B." in the December issue, with reference to information on ratings of old style, column type, cast iron radiators, I am pleased to submit the accompanying tables and miscellaneous data.

The tables and data have been obtained by me over a period of 14 years from old catalogs, text books, and data books published prior to the year 1925.

All of the ratings have thoroughly checked by means of actual use in the field on conversion jobs and remodelling work, in buildings of all classifications, with either steam, gravity hot water, or forced hot water as the heating medium.

Table 1 is self explanatory with respect to number of sections, overall radiator length, number of col-

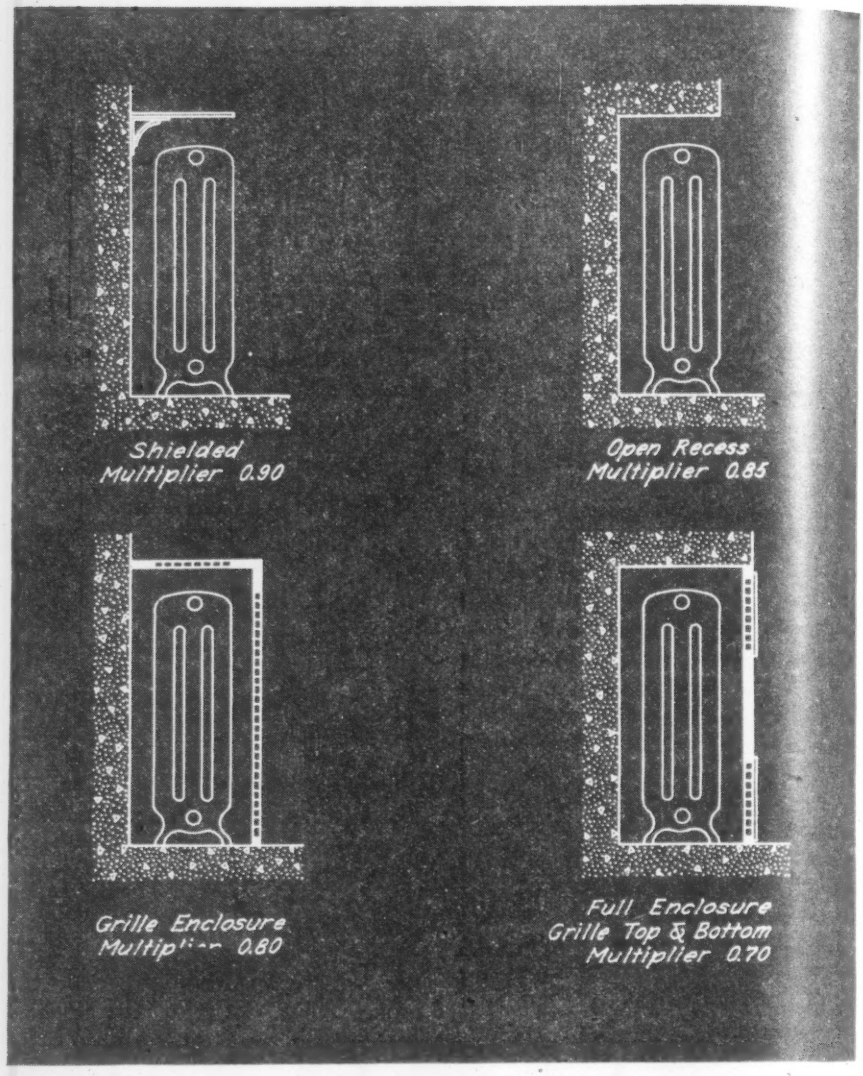


Fig. 1—Effect of enclosures on output of cast iron column type radiators. For method of using these factors, see footnote under Table 3

Table 1—Square feet of heating surface for cast iron direct column radiation; data furnished by "R.C.S." These ratings apply to radiators manufactured prior to 1925. 15 in. height was manufactured only in the two column type

No. of Sections	Length, in.	Single column						Two column						Three column						Four column					
		38	32	26	23	20	45	38	32	26	23	20	15	45	38	32	26	22	18	45	38	32	26	22	18
1	2½	3	2.5	2	1.66	1.5	5	4	3.33	2.66	2.33	2	1.5	6	5	4.5	3.75	3	2.25	10	8	6.5	5	4	3
2	5	6	5	4	3.33	3	10	8	6.66	5.33	4.66	4	3	12	10	9	7.5	6	4.5	20	16	13	10	8	6
3	7½	9	7.5	6	5	4.5	15	12	10	8	7	6	4.5	18	15	13.5	11.25	9	6.75	30	24	19.5	15	12	9
4	10	12	10	8	6.66	6	20	16	13.33	10.66	9.33	8	6	24	20	18	15	12	9	40	32	26	20	16	12
5	12½	15	12.5	10	8.33	7.5	25	20	16.66	13.33	11.66	10	7.5	30	25	22.5	18.75	15	11.25	50	40	32.5	25	20	15
6	15	18	15	12	10	9	30	24	20	16	14	12	9	36	30	27	22.5	18	13.5	60	48	39	30	24	18
7	17½	21	17.5	14	11.66	10.5	35	28	23.33	18.66	16.33	14	10.5	42	35	31.5	26.25	21	15.75	70	56	45.5	35	28	21
8	20	24	20	16	13.33	12	40	32	26.66	21.33	18.66	16	12	48	40	36	30	24	18	80	64	52	40	32	24
9	22½	27	22.5	18	15	13.5	45	36	30	24	21	18	13.5	54	45	40.5	33.75	27	20.25	90	72	58.5	45	36	27
10	25	30	25	20	16.66	15	50	40	33.33	26.66	23.33	20	15	60	50	45	37.5	30	22.5	100	80	65	50	40	30
11	27½	33	27.5	22	18.33	16.5	55	44	36.66	29.33	25.66	22	16.5	66	55	49.5	41.25	33	24.75	110	88	71.5	55	44	33
12	30	36	30	24	20	18	60	48	40	32	28	24	18	72	60	54	45	36	27	120	96	78	60	48	36
13	32½	39	32.5	26	21.66	19.5	65	52	43.33	34.66	30.33	26	19.5	78	65	58.5	48.75	39	29.25	130	104	84.5	65	52	39
14	35	42	35	28	23.33	21	70	56	46.66	37.33	32.66	28	21	84	70	63	52.5	42	31.5	140	112	91	70	56	42
15	37½	45	37.5	30	25	22.5	75	60	50	40	35	30	22.5	90	75	67.5	56.25	45	33.75	150	120	97.5	75	60	45
16	40	48	40	32	26.66	24	80	64	53.33	42.66	37.33	32	24	96	80	72	60	48	36	160	128	104	80	64	48
17	42½	51	42.5	34	28.33	25.5	85	68	56.66	45.33	39.66	34	25.5	102	85	76.5	63.75	51	38.25	170	136	110.5	85	68	51
18	45	54	45	36	30	27	90	72	60	48	42	36	27	108	90	81	67.5	54	40.5	180	144	117	90	72	54
19	47½	57	47.5	38	31.66	28.5	95	76	63.33	50.66	44.33	38	28.5	114	95	85.5	71.25	57	42.75	190	152	123.5	95	76	57
20	50	60	50	40	33.33	30	100	80	66.66	53.33	46.66	40	30	120	100	90	75	60	45	200	160	130	100	80	60
21	52½	63	52.5	42	35	31.5	105	84	70	56	49	42	31.5	126	105	94.5	78.75	63	47.25	210	168	136.5	105	84	63
22	55	66	55	44	36.66	33	110	88	73.33	58.66	51.33	44	33	132	110	99	82.5	66	49.5	220	176	143	110	88	66
23	57½	69	57.5	46	38.33	34.5	115	92	76.66	61.33	53.66	46	34.5	138	115	103.5	86.25	69	51.75	230	184	149.5	115	92	69
24	60	72	60	48	40	36	120	96	80	64	56	48	36	144	120	108	90	72	54	240	192	156	120	96	72
25	62½	75	62.5	50	41.66	37.5	125	100	83.33	66.66	58.33	50	37.5	150	125	112.5	93.75	75	56.25	250	200	162.5	125	100	75
26	65	78	65	52	43.33	39	130	104	86.66	69.33	60.66	52	39	156	130	117	97.5	78	58.5	260	208	169	130	104	78
27	67½	81	67.5	54	45	40.5	135	108	90	72	63	54	40.5	162	135	121.5	101.25	81	60.75	270	216	175.5	135	108	81

Table 2—Miscellaneous data and ratings furnished by "R.C.S."

Height of Radiator, in.	Rating, EDR per Section		
	Five Column	Six Column	Solid Type
12	—	3	—
13	3	—	—
14	—	3.25	—
16	3.5	3.75	—
17	—	4	—
18	4	4.33	—
20	5	5.25	3.25
22	6	—	—
23	—	—	4
26	7	—	4.5
28	—	—	5
32	8.5	—	5.75
38	10	—	7

Table 3—Effect of paint on radiator output, as given by "R.C.S."

Type of Finish on Radiator	Factor (Multiplier)
Bare radiator	1.00
Cream paint	1.04
White paint	1.02
Aluminum paint	0.91
Bronze paint	0.90

Note: To determine the net EDR rating or output of a radiator which is painted by any of the types of finishes listed in this table, or if it is shielded, enclosed, or partly enclosed, proceed as follows: Net EDR = $A \times B \times C \times D$, where A is rated EDR given in tables, B is number of sections in radiator, C is factor or multiplier for type of finish, and D is factor or multiplier for type of enclosure (as given in Fig. 1).

umns, and the rating in EDR listed below the radiator heights.

Table 2 has reference to radiators in the five and six column group and the solid type. Heights range from 12 to 38 in. with ratings listed per section.

Table 3 provides the multipliers to be used in determining net EDR when radiators are painted.

The sketches illustrate common types of enclosures used for the old type radiation and beneath each is the required multiplier necessary to determine the net EDR.—R.C.S.

DON'T USE THE OLD METHODS

ANSWERING the request from "R.L.B." published in the December issue for ratings of old style radiators, today's best source of information regarding not only old style radiators, but also early make boilers and auxiliary equipment as well as installation methods then in use, are the trade's text books of yesteryear.

However, such information can only be of academic interest to the man designing a modern heating system for an old building. Never should he make the mistake of sizing new radiation according to the existing old installation, for the job might have been put in by a contractor for whom I worked about a quarter of a century ago.

That gentleman never worried about what is now understood as specifications until the job, which he had estimated according to the system by which he also picked winners at the race track, was awarded him. One such happy day he yanked me out from behind my desk where I was "figgerin' out the radiation" and shortly after I found myself rushing behind him through the building in question trying to get on paper "thirty-five, twenty, forty-two, twenty-eight, etc., square feet, etc., etc." How it was done, I shall never know; perhaps by counting the number of steps it took him to hop from the door of one room to that of the other. As he slammed the front door, I heard the fateful words "If you get 'em all into the right rooms, it'll be O.K."

While such goings on pertain more or less to the small job, as far as the better and larger buildings were concerned, most such work was supervised in the old days by a field engineer of the manufacturer who furnished the boiler and/or the equipment making "the system." These jobs were frequently excellent.

Recently, I had occasion to convert to automatic firing such an old installation. After fitting the radiators with new thermostatic traps and installing a new boiler and condensate receiver, oil input having been determined at 4 gph, I decided to run some sort of a test before installing the burner and especially the combustion chamber. With the outside temperature around 60 at the time and the building vacant, I stuck a torch under the boiler, such as used by roofers for heating a tar kettle and firing maybe 2 gph of kerosene. This evenly heated all the radiation in the building, with the remotest radiators getting warm as soon as those nearest the boiler did. After about an hour and a half, all rooms were 70 to 72 deg. Such radiation, not to speak of the piping, should be contemplated by any man with the greatest respect.

In the ordinary job, however, the mere assumption that the system must have been found generally satisfactory in the past because no frozen bodies were discovered on the premises will lead to pitfalls. Many of the old occupants began feeling much warmer at the mere thought of having to go down and shovel coal. They also dressed warmer than their spoiled descendants and if the radiation heated unevenly, they did not believe the simple exercise of turning on and off a radiator here or there too strenuous.

Where there is found old hot water radiation in an existing building, the fact that modern practice involves much higher boiler water temperatures should not be overlooked, since this cuts such radiation down to the size of steam radiation.

Therefore, let those who live and breathe for the heating business, browse among the interesting relics of the dim past, if so inclined. But when it comes to new work, tell yourself "This has never been properly done before," and start from scratch, leaving preoccupation with those old radiators to the junkman. —W. O.

WHAT'S BEEN EXPERIENCE WITH CONTROL OF ODORS?

You are invited to answer the following question from "S.E.C." Suitable comment on this matter will be published, and paid for at regular rates (with additional payment for sketches). Address The Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"I am interested in any information that readers of HPAC might be willing to furnish based on their own experiences with control of odors in air conditioned buildings, particularly stores.

"As I understand it, there are several methods or techniques available for odor control, and I wonder which ones have proved feasible. Any comment reflecting actual experience along these lines would certainly be helpful to me, as we are investigating the matter in connection with our own buildings."—S.E.C.

INDUSTRY LEADERS PREDICT BUSY 19[illegible]9

Year End Statements Optimistic

PREDICTS EXPANDING ELECTRONIC CONTROL USE

Expanding use of electronic control devices for the home and factory was forecast in a special year end statement by Harold W. Sweatt, president of the Minneapolis-Honeywell Regulator Co.

Most of the electronic controls have been developed since the war and already are meeting ready acceptance in the home and industry alike so that further production increases can be expected in the coming year, he said.

"Meanwhile, the outlook for the control industry as a whole continues to reflect the high national rate of construction, and the growing tendency of industry and the home owner alike to transfer to automatic operation many operations formerly done manually," Mr. Sweatt said.

The air conditioning industry, he continued, completed the biggest year in its history during 1948. In part responsible for this achievement was the high rate of construction of such structures as theaters, stores, schools, and hospitals. In addition, however, Mr. Sweatt cited the growing use of air conditioning for such industrial processes as textile manufacture, precision electrical components, and high grade papers. He referred to a recently completed eastern factory wherein rigidly controlled air conditioning is depended upon to eliminate dust and avoid equipment damage which would result from the slightest trace of perspiration from a worker's hands. The air conditioning of this plant requires almost four miles of ducts, and it processes three-quarters of a million cubic feet of air a minute.

The industrial control makers likewise have completed the biggest year in their history, he said, and look forward to continued high production rates.

Several new electronic heating and air conditioning control systems were put on the market for the first time last year and are expected to be sold in considerable volume during 1949, he said. Among these is a new control system for air conditioning which is 100 times more sensitive than previous means, contains no moving parts in its thermostats, and simplifies installation.

OIL BURNER SALES WILL TOP '48 FIGURE

Sales of power driven oil burner equipment for 1949 should be approximately 550,000 to 600,000, a substantial increase over the quantity sold in 1948, according to R. S. Bohn, president of the Oil-Heat Institute of America.

Sales in 1948 did not meet the 1947 figure because of "scare" headlines about oil and certain material shortages, which were responsible for retarding sales in the early part of 1948. However, when this "shortage" talk was stopped, the sales curve showed a steady upward trend during the latter months of the year, Mr. Bohn said last month.

WHAT ABOUT FUTURE CONSTRUCTION COSTS?

Contractors throughout the country have been giving concentrated thought to the question of future construction costs. Through the Associated General Contractors, they have adopted statements to inform the public on this subject. In substance, this is what they have said:

1) In an economy subjected to the inflationary pressures of World War II construction costs generally cannot return to levels prevailing before the war unless the nation suffers an economic catastrophe.

2) The public should not be led to believe that there will be quick or drastic reductions in construction costs.

3) Reductions will come through the elimination of business uncertainties, increased productivity of workmen, increased efficiency of management, improved design, development of more efficient methods of construction, and other factors. These will come abo[illegible] but the changes will be gradual.

There are indications th[illegible] construction costs are tending [illegible] level off and stabilize. Many othe[illegible] prices in our economy are leveling [illegible] now and are at or near the price[illegible] which have been prevailing recent[illegible] The same is true in constructi[illegible] according to Dwight W. Wink[illegible]man president of the AGC.

"If you wish to predict the future of construction costs, you will not be far wrong, probably, if you estimate that they will follow the same general trend as the prices in our economy as a whole," he says.

COPPER TUBE IN WIDE DEMAND FOR HEATING

Whether or not there will be a sufficient supply of copper, zinc, and lead in 1949 to meet the requirements of the brass mills, wire mills and other copper consuming industries will largely depend on the following three factors, according to T. E. Veltfort, manager of the Copper & Brass Research Association:

1) The amount of these strategic metals that the government will stockpile in the defense program.

2) The labor situation in the mines, mills, and in transport. Capacity production will be necessary to meet current demand.

3) The quantity of these metals which can be imported from abroad, and in turn, the shipments which will have to be made abroad on account of the European recovery program.

Even though there are no labor disturbances in the copper mines during the year and they are operated at capacity, they cannot supply enough copper to meet domestic requirements. It is generally believed that 1949 will be one of continued prosperity in our country. If this turns out to be true, the demand for copper may well reach 1,400,000 tons. The mines in the United States cannot produce such a tonnage so it will be necessary to import the red metal from the

Mexican and South American mines generally operated by companies in the United States, he said. The amount of secondary metal (scrap) will also play an important part in meeting demand.

Copper tube is in great demand for hot and cold water lines, vent, soil and waste lines, and for radiant heating. Some manufacturers of copper tube have since the end of the last war almost doubled capacity, but demand has exceeded output due largely to the use of copper tube for radiant heating in all types of buildings. This product is being turned out at more than four times the prewar average, Mr. Veltfort stated.

GOOD AIR CONDITIONING YEAR EXPECTED

The air conditioning industry as a whole has every reason to expect a good year in 1949, always providing there is no major upheaval in our domestic economy. However strange it may seem, one of the major reasons for this expectation is the return of more normal competitive conditions throughout business generally, according to Cloud Wampler, president of Carrier Corp.

As competition increases, the use of air conditioning becomes increasingly necessary as a tool for improving industrial products and attracting more customers in commerce, he says. In fact, the marketing of such equipment—in contrast to earlier days when it was usually considered a luxury—now is based largely upon the profit motive of the buyer.

Within the air conditioning industry itself a more nearly normal seasonal pattern already has been established. Pipe lines are being filled on some of the lighter product lines, and this in itself spells a return to usual competitive conditions, Mr. Wampler states.

The business volume of Carrier Corp. in fiscal 1948 was the highest in its history, and current bookings of new business are satisfactory. While no forecast has been made for the last half of 1949, present indications are that good business will prevail at least during the first six months, according to Mr. Wampler. However, Carrier along with many other corporations has been hampered by critical shortages of various materials.

AIR CONDITIONING OUTLOOK ENCOURAGING

At two separate meetings recently, Worthington Pump and Machinery Corp. officials told distributors that air conditioning and refrigeration products have stepped from the luxury group to the essential.

In speaking of the future of the industry, M. M. Lawler, manager of the air conditioning and refrigeration division, said that "we have hardly scratched the surface of the applications and markets available. Thousands of chemical and pharmaceutical products must have controlled temperature and humidity conditions as they move through the various phases of manufacture and storage. Mining and metal working, autos and aircraft, papermaking and printing, transportation and communication, clothing, photographic materials, precision instruments, and electronic equipment are only a few of the broad industry classifications dependent, in varying degrees, on refrigeration and air conditioning."

William F. Bishop, assistant manager in charge of air conditioning and refrigeration distributor sales, pointed to a 400 percent increase since 1940. "The market for air conditioning and refrigeration equipment," he said, "has expanded in leaps and bounds in the last five years. Employment in the industry has increased 63 percent since 1937. Factory billings in 1940 were approximately $50 million. Factory billings for 1948 were approximately $220 million—an increase of over 400 percent.

"This market will continue to expand," Mr. Bishop continued. "In addition to the normal program of new construction and expanded facilities in all fields requiring the usual applications, there are many new and essential applications being devised daily. No other industry has such a promising outlook . . . has so many potential customers in every commercial and industrial field.'"

DEMAND FOR CONVECTORS CONTINUES

Continued consumer demand for nonferrous convector radiators in new and modernized homes, apartments, schools, hospitals, and other institutional buildings was reflected in total shipments of 412,019 convector units in the first nine months of 1948. A two and one-half to three months' backlog in orders in the industry as a result of short steel supply was reported by L. D. Mandell, president of the Convector Manufacturers Association, at the year's end.

"The outlook for 1949 is encouraging, depending entirely upon the industry's ability to secure sufficient steel to meet production demands," Mr. Mandell said. "Consumer demand is strong and will increase rapidly as building grows. The industry operated in 1948 without government support of steel supply, through allocations, which was a substantial aid in the first six months of 1947. Despite this handicap, shipments in 1948 were only 31,909 units behind the record nine months total of 443,928 units achieved in 1947."

SEES MORE HEATING SALES

"Sales of automatic heating equipment in 1949 will not reach the peak set in 1947, but will be considerably better than 1948," S. H. Shipley, president of York-Shipley, Inc., York, Pa., believes.

"The year just completed was a tough one because of the oil shortage scare which hovered over the industry during the first six months," Mr. Shipley continued, "but sales returned to good levels during the last half."

In the industrial field, Mr. Shipley believes that sales will increase greatly "because of the operating economies shown by packaged steam generators which combine the boiler and burner in one unit." These generators operate with oil or gas or a combination of the two.

Pressure Vessel Head Theory Perfected

RECENT developments in pressure vessel head stress theory, together with stress computations now under way, are being verified by strain measurements on pressurized vessels and ultimately the net result will consist of tables and curves which will provide a better understanding of pressure vessel design, according to W. R. Burrows, assistant chief engineer, Whiting refinery, Standard Oil Co. (Indiana), in a recent talk before the American Society of Mechanical Engineers Chicago section junior group.

As chairman of the design division of the pressure vessel research committee of the Welding Research Council, Mr. Burrows has been instrumental in perfecting the theory of pressure vessel heads in the elastic range. In his talk, which was confined to the juncture problem, he stressed the intermediate character of the theoretical work and stated that it represents the arranging of basic theory in a form suitable for computing values.

He pointed out that basic pressure vessel theory had its rise in the work on shells of Mlle. Sophie Germain in France at the beginning of the 19th century and was brought to its present form by Augustus Love at Oxford, about 100 years later. Its application was advanced by Hans Reissner in Germany, by Ernst Meissner in Switzerland, and by others.

The Love-Meissner theory, he said, accurately applies to cylinders and these cylinder solutions have been used to approximate other head shapes because of the mathematical simplicity although the results have not been very successful, except for the case of the cone. He reported that a better understanding of the theory now makes its use possible, in spite of the mathematical complexity, for all common pressure vessel head shapes—in lieu of resorting to approximations based on the easier but less accurate method of equivalent cylinders.

Mr. Burrows defined the juncture problem as the very specific problem of the stress disturbance at the head juncture due to the inequality of the natural, radial internal pressure deformations of the head and of the cylinder being forced into equality by their rigid attachment to each other. This stress disturbance is local in character, damps out as the distance from the juncture increases, and is superimposed on the normal stress system.

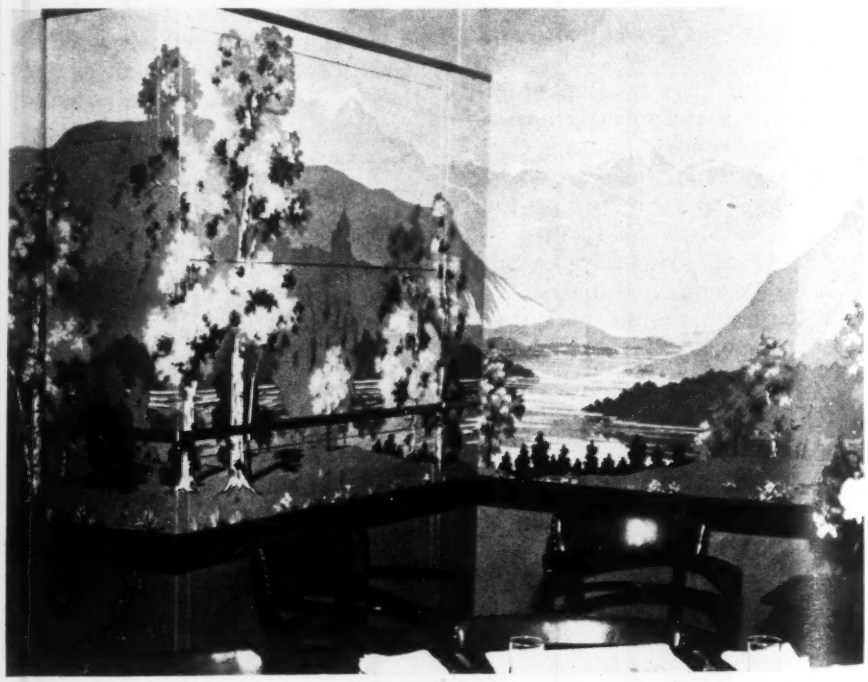
After mentioning commonly used head shapes, such as spherical, ellipsoidal, conical, toriconical, torispherical, and the flat head, he summarized the problem by saying that the design engineer must have accurate data (for any point in the head or at the shell and head juncture) on stresses due to axial tension, axial moment, circumferential tension, circumferential moment, and shear. He then outlined the mathematical procedures involved and discussed the restrictive conditions under which solutions can be made. In his opinion, the intermediate, mathematical organization work has done much to get the problem out of the "can't see the forest for the trees" situation but much remains to be done—particularly the improvement of the present solution of a fourth-order differential equation.

Mr. Burrows said that the strain measurements by Professor Durm and his staff at Purdue University have thus far confirmed the accuracy of results. He mentioned also that stress computations covering a wide but practical range of head sizes and thicknesses are being performed by Doctors Dudley and Lang of the Standard Oil Co. engineering research department. In regard to other pressure vessel design problems—such as openings, reinforcements, supports, external loads, etc.—he cited the work now being carried out by the pressure vessel research committee and other organizations.

AIR CONDITIONING UNIT BLENDS WITH DECOR

The ease with which a packaged air conditioner may become an integral part of a decorative scheme is exemplified at the Town club, Jamestown, N. Y. The installation was made by Sprinchorn and Co. The unit is equipped with steam coils for heating, an oil fired boiler supplying the steam (photo courtesy Airtemp Div., Chrysler Corp.

"Invisible" unit heats and cools club



DATA SHEET

INSTRUCTIONS FOR INSTALLING AND OPERATING RECIPROCATING PUMPS

THE FOLLOWING instructions for installing and operating reciprocating pumps (concluded from the January issue) have been reprinted by permission from the reciprocating pump section of the Standards of the Hydraulic Institute, copyright, 1948, by the Hydraulic Institute, New York. The original numbering of the paragraphs has been retained

D-99. **Air Chambers.** The suction and discharge pipe layout for reciprocating steam and power pumps of conventional type is frequently such that no devices are necessary to compensate for normal variations in velocity of flow in the piping system.

Where the suction or discharge lines, or both, are of considerable length, where water comes to the pump under a static head, where the pump speed in revolutions per minute is high, or where the liquid handled is hot, air chamber of suitable size on the suction or discharge lines, or both, may be found necessary to insure smooth, quiet, operation of the unit. The size of the chamber will depend upon the type of pump and the layout of the piping system. Recommendations as to size and type of air chambers should be obtained from pump manufacturer, making sure to send full information as to piping installation to be used in any given case. Without knowledge of the layout of the piping to be used, it is not possible for the manufacturer to intelligently determine the size of air chamber, or whether such chambers will or will not be necessary. Except in those special types of pumps where manufacturers' standards include such equipment, air chambers should be considered as a part of the piping system.

In general, suction air chambers are more frequently required than are discharge air chambers. Suitable air chambers can now be constructed cheaply of pipe and fittings by welding. In the following list, pump types are arranged in order of their relative smoothness of flow, the type first listed most frequently requiring air chamber compensation:

(a) **Power Pumps:**

Single——Single Acting
Single——Double Acting
Duplex——Single Acting
Duplex——Double Acting
Triplex——Single and Double Acting
Quintuplex—Single and Double Acting

(b) **Steam Pumps:**

Single——Double Acting
Duplex——Double Acting

Where air chambers are used, provision should be made to keep the chamber charged with air. An air chamber filled with liquid is of no value. A water level gage is desirable to permit a check on the amount of air in the air chamber.

Air chambers, particularly on the suction, should be located as close as is possible to the pump, and in such position as will provide a direct continuation for the flow of water in the line, as in such position the air chamber will absorb the impact of the moving water column and thus cushion pulsations in the most efficient manner.

D-100. **Lubrication, Steam Pumps.** The steam cylinders should be well lubricated before starting by means of a hand oil pump. For small steam driven pumps, a sight feed lubricator is recommended. Large size steam driven pumps and all pumps that are operated with superheated steam should be fitted with mechanical oil pumps. Avoid feeding too much oil to small steam pumps to prevent clogging of small steam ports.

D-101. **Lubrication, Power Pumps.** Before starting power pumps for the first time, care should be taken to be sure that bearing surfaces are clean and free from foreign materials. The type of lubrication used should be recommended by the pump manufacturer.

D-102. **Packing.** Stuffing boxes should be evenly fitted with good quality packing. Do not screw glands up too tight or rods and plungers will score. Pumps operated with superheated steam should have all stuffing boxes on the steam end fitted with metallic packing. The liquid end should be fitted with packing suitable for the liquid that is to be pumped.

D-103. **Valve Setting.** (a) Set steam piston at midstroke. To do this pry against the crosshead until the steam piston strikes the cylinder head. Make a mark on the piston rod close to the face of the steam end piston rod stuffing box gland. Move the piston to the opposite end of the stroke and make a mark on the rod half way between the first mark and the face of the steam end stuffing box gland. Now, move the piston backward until the second mark is flush with the face of the gland and the piston will stand at midstroke.

(b) For pump with inside fixed lost motion. Center the steam piston. Remove steam chest cover. Disconnect the link from the knuckle of the valve rod. Place the slide valve so that both steam ports are covered. Hold the valve nut exactly in the center of the space between the valve lugs. Screw the valve rod through this nut until the knuckle eye is in line with the link eye and push the link pin in place. Repeat this process with the other side and the operation is complete. After everything is adjusted and before replacing the chest cover, move one of the slide valves off center so as to leave the steam port open, otherwise the pump cannot be started. In operation, both valves will never be on center at the same time under any condition of running. It is only when the valves are deliberately placed, as in setting, that it can happen.

(c) For valve rod with lock nuts at each end of the slide valve. Place pistons and slide valves on centers, remove the valve chest cover. Do not disconnect the valve rod from the link. After valve is centered, set and lock the nuts at equal distances from the outer faces of the valve lugs, allowing about half the width of the steam port for lost motion on each side. If this allowance gives too much or too little length of stroke, the lost motion will have to be altered by trial until the pump makes the desired stroke.

(d) For valve with outside adjustment. Set the piston and valves on center. Move the collars on the valve rod link so that they will be about half the width of the steam port away from the tappet. Repeat this operation on the opposite side. Start the pump. If the stroke is too short, the collars may be screwed further apart. Care should be taken to turn back all of the collars the same amount. When the final adjustment is made, lock the collars securely in place. The valves of a compound duplex pump are set in exactly the same manner as the simplex pumps except that two valves are to be considered instead of one.

[Concluded on next page]

D-104. Steam Valves for Other Than Standard Duplex Steam Pumps. Steam ends having semi-rotative valves should be adjusted by a skilled engineer or erecting man. The steam valves of the single pumps are set before leaving the factory and do not require adjustment in the field. The steam valves of duplex pumps that are shipped completely assembled are set in the factory and do not require adjustment in the field; but, when such adjustments are necessary, the foregoing instructions are applied.

D-105. Steam Valves. The steam economy of a pump equipped with piston valves is no better than that of a similar pump operating under the same conditions equipped with slide valves.

D-106. Drains. Always open the steam cylinder drain valves before starting, to allow condensate to escape and to prevent damage to the cylinder heads. When the pump is shut down in cold weather, always drain the liquid cylinders to prevent freezing.

D-107. Power Pump Gear Drive. Mesh the pinion into the gear with a slight clearance. For small gears, approximately 0.002" to 0.003". For larger gears, the clearance should not exceed 0.005" to 0.006". If the driven pinion is of rawhide or similar material, the clearance should slightly exceed the figures stated, especially if cons able moisture is present, as a slight expansion occur. The minimum clearance for a rawhide pi should be approximately 0.003" to 0.004". Gears bet the pump and prime mover must have a perfect bea across the entire width of the face of the gear pinion. To test the tooth bearing, insert a piece of paper at each end of one tooth on the gear. F these pieces of paper on the bearing side of the t then turn gear or pinion sufficiently to bring into the paper tooth. If the bearing across the face o gear and pinion is correct, the pressure on the pieces of paper will be equal.

D-108. Power Pump Bearings. Make sure that bearings are tight. Do not allow a pump to run loose bearings. This will destroy the bearings and in time cause cracks or breakage in the pump fr Adjust the crosshead shoes when necessary to pensate for wear in crossheads or guides.

D-109. Inspection. Inspect the pump frequently see that all valves are tight. Leaky valves should refaced as soon as they are discovered. Most pump troubles can be traced to poor packing, fouled water cylinders, worn liquid valves, or to faulty conditions outside the pump itself.

ARE RADIANT HEATING JOBS OVERDESIGNED?

THE AUTHORS of the article in the January issue on the new chart for radiant heating design have not given us sufficient information to enable us to comment as fully as we might like to on its use.

We agree with the authors that most "existing methods of calculation result in heating systems that are overdesigned." There are two probable causes for this condition, namely the use of improper assumptions on the part of the designer of the heating system and the method used for determining the Btu input requirements.

One of the assumptions relates to the ventilation rate. If the crack method is used, the designer must assume the width of crack and the wind velocity. If the air change method is used, the value used for the ventilation rate will generally be higher than that determined by the crack method and the chance of error between it and the real value may be considerable.

Another assumption relates to outdoor design temperature. We are inclined to agree with Clark M. Humphreys of the ASHVE research laboratory staff in his suggestion (ASHVE Journal Section, HPAC, January 1948) "that winter design temperatures be selected on the basis of probable frequency of recurrence of *low daily mean* temperatures. If *minimum* outdoor temperatures are used, the system will probably be overdesigned."

The second cause referred to in the second paragraph of these comments might be the subject of considerable discussion, especially with respect to radiant heating systems. It will be found that the Btu input requirements for a radiant heating system determined by a procedure based on rational analytical methods (Panel Heating and Cooling Analysis, by B. F. Raber and F. W. Hutchinson, ASHVE Transactions, Vol. 47, 1941) will be less than those determined by the method commonly used for conventional systems in the lower range of outdoor temperatures and greater in the higher range of outdoor temperatures. This is because the heat output from the panel in a radiant heating system is a direct function of the heating load. (ASHVE Research Report No. 1192—Panel Heating and Cooling Performance Studies, by B. F. Raber and F. W. Hutchinson, ASHVE Transactions, Vol. 48, 1942).

If then, the system is improperly designed, the throttling of the flow that Messrs. Fairbairn and Goemann, the authors of the January 1949 article, refer to will certainly not produce results in accordance with those expected.

An interesting comment on the development of a U coefficient is given in a paper entitled Experimental Studies on Panel Heating Tube Spacing, by B. F. Raber and F. W. Hutchinson (ASHVE Journal Section, HPAC, August 1947) from which we quote as follows:

". . . . . an 'overall' correlation of panel ratings in terms of water-to-air or surface-to-air temperature differences is irrational and unlikely to lead to dependable coefficients."

Quoting further from the same reference we find that "the problem of panel rating is visualized as requiring the determination of a conductance rather than an overall coefficient; the conductance of the panel from water within the tube to the panel surface."

Without knowing how the authors of the January 1949 article determined the U coefficient of 0.46 Btu per ft of tube per hr per F difference between the water temperature in the tube and the room air temperature, it appears from our own rough calculations that it may be based on the theory of 3.5 per sq ft of pipe or tube surface per F difference as above. Recorded conditions of our own investigations, however, involving both laboratory test panels and panels in occupied buildings have not indicated anything leading to a verification of that theory.

We can see no reason for the use of assumed correction factors ranging from 10 to 20 percent. Would it not be better to correct the original values in the calculations so that the correction factors mentioned would be unnecessary?

The chart that the authors have developed and which is reproduced in the January 1949 HPAC is indeed ingenious and may be of considerable help to anyone who is willing to accept their method of design.—D. L. MILLS, research dept., Revere Copper and Brass, Inc., Rome, N. Y.

Heating, Piping & Air Conditioning
AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS
Journal Section

Physiologic Adjustments of Normal Subjects and Cardiac Patients to Sudden Change In Environment

By Nathaniel Glickman*, Tohru Inouye**, Robert W. Keeton°, M.D., Irwin R. Callen†, M.D., Ford K. Hick††, M.D., Chicago, Ill., and Maurice K. Fahnestock‡, Urbana, Ill.

This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in cooperation with the University of Illinois, College of Medicine

SUMMARY — Physiological adjustments on exposure to sudden change in environmental temperature of 16 cardiac patients were compared with those of 10 normal subjects. Test subjects were transferred from a comfortable room to a hot room and back to a comfortable room.

The results indicated that the observed responses of cardiac patients on exposure to sudden change in environmental temperature were similar in most respects to those of young normal subjects. The few definite differences that did appear may represent differences which would have been observed as a result of the ageing process in relatively normal individuals

THE RAPIDITY and magnitude of certain physiological adjustments of healthy young adult males on exposure to sudden changes in environmental temperature and humidity have been reported[1,2]. The adjustments occurred rapidly and placed little strain on the cardiovascular system. This is in accord with general experience of the public that no ill effects are apparent to normal individuals making the adjustments required by entering and leaving an air conditioned space during the hot summer months. The purpose of the present study was to compare the responses of individuals with impaired cardiovascular systems with those of normal subjects when each group was exposed to sudden changes in the environmental temperature and humidity.

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[1-2] Exponent numerals refer to References.
Presented at the 55th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Chicago, Ill., January 1949.

Subjects

Ten healthy male medical students, ranging in age from 19 to 29 years (average 23 years), were the subjects for the control series. Sixteen male patients with cardiovascular impairment, ranging in age from 25 to 72 years (average 57 years), were the subjects for comparison. The clinical diagnosis and functional classification, according to the *American Heart Association*[3], of all patients, are presented in Table 1.

Procedure, Observations and Experimental Conditions

The procedure, observations and experimental conditions were the same for the normal subjects and

Table 1—Diagnosis and Classification of the Patients

DIAGNOSIS	Patient Number	Age	Blood Pressure	Functional Classification[a]
A. Arteriosclerotic Heart Disease				
(1) without evidence of coronary disease...	1	72	144/88	I
	2	69	174/72	II
(2) with evidence of coronary disease.....	3	72	174/72	II
	4	65	166/88	II
(3) with old myocardial infarction.....	5	56	142/86	I
	6	60	140/88	II
B. Hypertensive Cardiovascular Disease				
(1) without evidence of coronary disease....	7	66	190/106	I
	8	52	232/140	I
	9	42	212/130	III
(2) with evidence of coronary disease.....	10	57	162/88	II
	11	69	156/92	II
C. Hypertensive and Arteriosclerotic Heart Disease				
(1) with evidence of coronary disease.....	12	62	160/88	III
D. Valvular Cardiac Disease				
(1) rheumatic etiology.....	13	45	134/94	I
	14	25	100/70	III
	15	43	148/80	I
(2) syphilitic etiology.....	16	48	138/40	III

[a]Classification according to *American Heart Association:*

"Class I. Patients . . . without limitation of physical activity. Ordinary physical activity causes no discomfort.

"Class II. Patients . . . with slight to moderate limitation of physical activity. Ordinary physical activity causes discomfort.

"Class III. Patients . . . with moderate to great limitation of physical activity. Less than ordinary physical activity causes discomfort.

"Class IV. Patients . . . unable to carry on any physical activity without discomfort."

cardiac patients and have been described in detail in a previous paper[1]. The subjects and patients (dressed in thermocouple union suits) remained in the comfortable room (designated comfortable room 1) for one hour and then entered and remained in the hot room for one hour after which they returned to the comfortable room (designated comfortable room 2) for one hour.

Observations included skin and rectal temperatures, evaporative weight loss, time of onset of perspiration, blood pressure, pulse rate and subjective sensation of warmth or coolness.

The scale for the subjective sensation of comfort was similar to that described in an earlier paper[1] and was: (1) Cold; (2) Cool; (3) Slightly cool; (4) Comfortable; (5) Slightly warm; (6) Warm; (7) Hot.

The subjects were trained in the use of the comfort scale before starting the series of experiments. Intermediate votes such as 2½, 3½, or 4½ were accepted during the adjustment period.

The comfortable room was maintained at a constant dry bulb temperature of 76 F and a water vapor pressure of 0.356 psi corresponding to a relative humidity of 80 percent and an effective temperature of 73.4. The hot room was maintained at a dry bulb temperature of 98.5 F and a water vapor pressure of 0.599 psi corresponding to a relative humidity of 66 percent and an effective temperature of 90.2.

Statistical Analysis of the Data. Fisher's modification[4] (p.107) of Student's method for the comparison of two groups of unpaired data was used. The probabilities were taken from Student's tables and differences were considered significant when the probability was less than 0.030.

Results

The mean values for normal subjects and cardiac patients under comfortable conditions in equilibrium with the environment (comfortable room 1) are shown in the Figs. 1, 2, and 3. The final values for mean skin temperature averaged 92.4 F for the normal subjects and 91.5 F for the patients. The difference of 0.9 F was statistically significant (P=0.013). No significant differences were found between the normal subjects and cardiac patients in final rectal temperature, final comfort vote, final pulse rate and average rate of evaporative weight loss. The blood pressure was significantly higher in the cardiac patients than in the normal subjects; the systolic pressure averaged 55.5 mm Hg higher (P = 0.003) and the diastolic pressure averaged 22.4 mm Hg higher (P = 0.025). This was anticipated because of the large difference in age.

Mean Skin Temperature. The rapidity and magnitude of the change

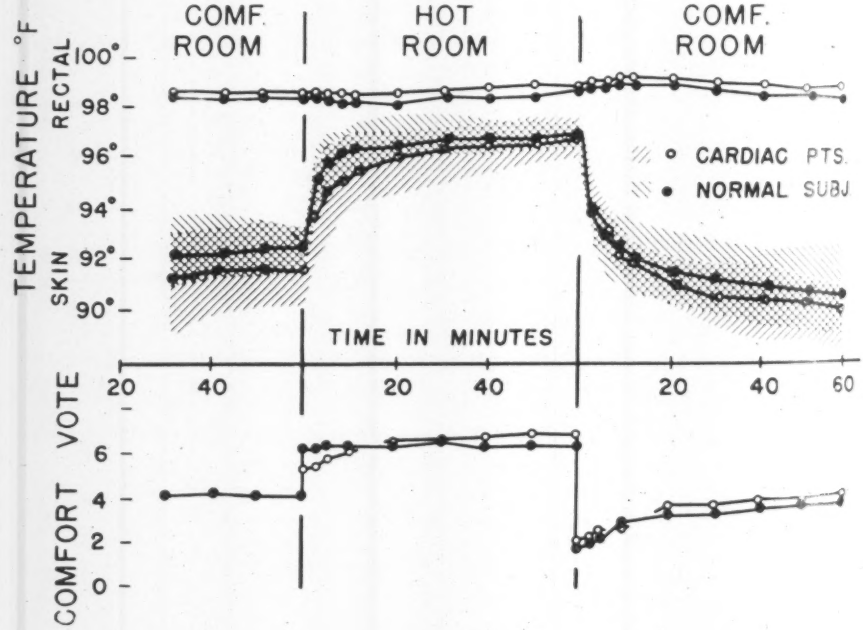

Fig. 1—Averages for rectal and mean skin temperature and comfort vote for normal subjects and cardiac patients in comfortable room 1, hot room and comfortable room 2.

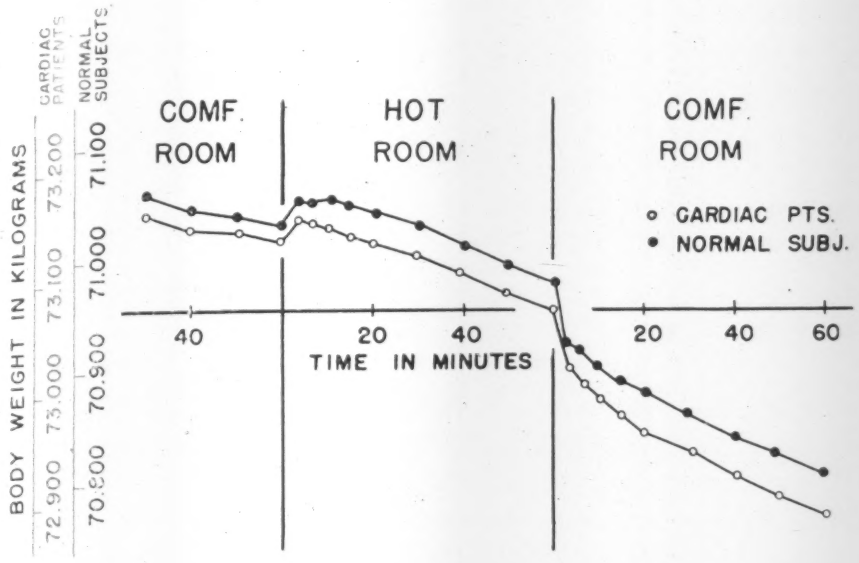

Fig. 2—Averages for body weight for normal subjects and cardiac patients in comfortable room 1, hot room and comfortable room 2

in mean skin temperature of the normal subjects and cardiac patients can be seen in Fig. 1. Although the final mean skin temperature in comfortable room 1 averaged 0.9 F deg lower for the cardiac patients than for the normal subjects, the increase 10 min after entering the hot room was the same (3.8 F deg) for both groups. This would suggest that the warming curve might be different. However, an analysis of the data, using only the experiments in which the final mean skin temperature in comfortable room 1 ranged from 91.4 to 93.2 F for the normal subjects (9 experiments) and 91.0 to 93.4 F for the cardiac patients (10 experiments) with averages of 92.0 F for both groups, revealed that the increase 10 min after entering the hot room was the same. At the end of the hour in the hot room there was no difference in mean skin temperature between groups. The temperature was 96.9 F for the normal subjects and 96.8 F for the cardiac patients.

In comfortable room 2, after the hot room exposure, no statistically significant differences in decrease of mean skin temperature occurred. The slight divergence after 20 min (Fig. 1) merely reflects the somewhat greater, but not significant, amount of moisture present in the union suits of the cardiac patients.

The skin temperatures of various segments of the body of normal subjects and cardiac patients were compared. Only the temperature of the foot was found to be significantly different. The final comfortable room 1 temperature of the heel and toe averaged 91.6 and 88.9 F respectively, for the normal subjects and 84.2 and 85.1 F respectively, for the cardiac patients. Even after one hour in the hot room the foot temperature remained definitely different. The heel and toe temperatures averaged 97.9 and 97.3 F respectively, for the normal subjects and 96.4 and 94.6 F respectively, for the cardiac patients. At the end of the hour in comfortable room 2 however, only the toe temperature was significantly lower for the cardiac patients (90.7 as compared to 88.2 F).

Rectal Temperature. The rectal temperature has been shown[1,2] to decrease slightly within 10 min of entering a hot environment. This is due to a transfer of heat from the deep to the superficial tissues as a result of the rapid redistribution of blood. The rectal temperature (Fig. 1) decreased within 10 min after entering the hot room, an average of 0.26 F ($P < 0.001$) in the normal subjects and an average of 0.12 F ($P = 0.008$) in the cardiac patients. The very small difference between groups was statistically significant ($P = 0.018$) but of little clinical importance. The rectal temperature increased slightly for both

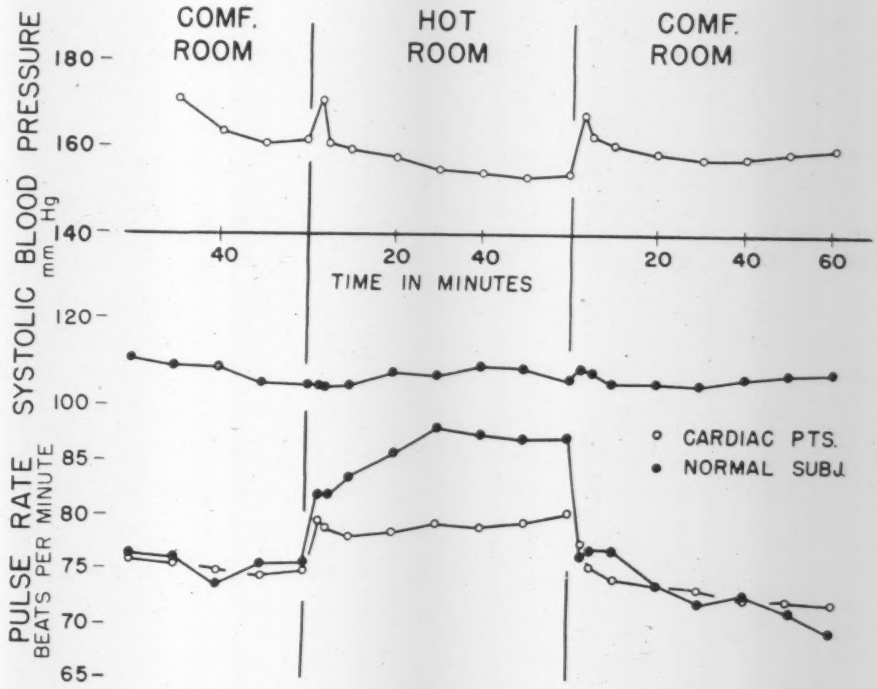

Fig. 3—Averages for systolic pressure and pulse rate for normal subjects and cardiac patients in comfortable room 1, hot room and comfortable room 2

groups by the end of the hour in the hot room but there was no real difference between groups.

On entering comfortable room 2, after the hot room exposure, there was a similar small, but statistically significant, increase in rectal temperature in both groups ($P < 0.001$). This has been previously reported for normal subjects[1,2,6,7]. Thereafter, the rectal temperature decreased slowly with no definite differences between groups.

Perspiration and Evaporation. The time of appearance of visible perspiration in the hot room varied widely in both groups. The average time of appearance was 9.3 and 11.2 min in the normal subjects and cardiac patients, respectively. The difference was not significant and indicated that the cardiac patients could perspire as readily as the normal subjects.

The estimated water loss (perspiration[2]) during the one hour in the hot room averaged 224 gms for the normal subjects and 282 for the cardiac patients. The difference of 58 gms was not statistically significant.

There was no real difference between groups in the estimated amount of available moisture on the skin and in the union suit at the time of entrance into comfortable room 2. Further, there was no significant difference in the total amount of evaporation which occurred in the hot room and in comfortable room 2 (Fig. 2).

Pulse Rate. The final pulse rate in comfortable room 1, as shown in Fig. 3, was about the same for the normal subjects and cardiac patients. Also the increase 3 min after entering the hot room was about the same (6.3 and 5.7 beats per minute for the normal subjects and cardiac patients, respectively). On the other hand, the normal subjects had an average increase in pulse rate of 12.0 beats per minute from the end of the comfortable room 1 to the end of the hot room exposure; whereas, the cardiac patients had an average increase of only 6.1 beats per minute. The difference was definite ($P = 0.005$). Thus, the initial adjustment of the pulse rate on exposure to the hot room was the same for both groups but the response thereafter was different. After the initial response, the normal subjects showed a further small increase which was not shown by the cardiac patients.

On entering comfortable room 2, after the hot room exposure, the pulse rate of the normal subjects decreased an average of 10.6 beats per minute while that of the cardiac patients decreased only 2.3 beats per minute. The difference was statistically highly significant ($P = 0.003$). Thereafter, the pulse rate in comfortable room 2 was about the same for the two groups.

Blood Pressure. The normal subjects had an average increase in systolic pressure of 3.8 mm Hg on entering the hot room and the cardiac patients an average increase of 10.5 mm Hg (Fig. 3). This difference was not significant. Further, there was no real difference in the magnitude of the increase in systolic pressure on entering comfortable room 2 even though the increase averaged 16.3 mm Hg for the cardiac patients and only 7.3 mm Hg for the normal subjects.

There were no significant differences in changes of diastolic pressure at any time during the experiment.

Comfort Vote. The comfort vote immediately on entering the hot room averaged 6.2 and 5.3 for the normal subjects and cardiac patients, respectively (Fig. 1). The difference was definite ($P < 0.001$) and indicated that the subjective sensation of warmth on entering the hot room was distinctly greater for the normal subjects. However, the difference remained significant for only the first five minutes. The subjective sensation of warmth changed little for the normal subjects after entrance; whereas, it continued to increase for the cardiac patients. By the end of the hour in the hot room the cardiac patients definitely ($P = 0.023$) felt warmer than the normal subjects.

The comfort vote immediately on entering comfortable room 2 and during the remainder of the hour in this room was similar for both groups.

Discussion

The final mean skin temp[illegible]ture in comfortable room 1 was [illegible]tistically significantly lower [illegible] the cardiac patients than for t[illegible] normal subjects. However, the [illegible]fference amounts to only 0.9 [illegible] and clinically would be of little [illegible]portance.

The lower temperature of t[illegible] foot of the cardiac patients p[illegible]ably represents vascular change [illegible]ncident to their disease of the[illegible] age. Their blood vessels do not di[illegible]te as readily as do those of norma[illegible] subjects.

There appeared to be no greater stress on the cardiovascular system of the cardiac patients than that of the normal subjects as measured by changes in pulse rate. The cardiac patients had less of an increase in pulse rate on entering the hot room, less of an overall increase during the hot room exposure and less of a decrease on entering comfortable room 2.

Summary and Conclusions

Physiological adjustments on exposure to sudden changes in environmental temperature of 16 cardiac patients were compared with those of 10 normal subjects. The data obtained justify the following conclusions:

1. The cardiac patients had a significantly lower final mean skin temperature (0.9 F) in comfortable room 1 but thereafter the changes were similar to the normal subjects.
2. The cardiac patients had a significantly lower foot temperature throughout the experiment. Other segments of the body revealed no differences.
3. No differences in rectal temperature were observed with one minor exception.
4. No differences were observed in the average rate of evaporative weight loss. There were no differences in the time of onset of visible perspiration and in the amount of perspiration.
5. The pulse rate of the cardiac patients increased less during the hot room exposure and decreased less on entering comfortable room 2. Other adjustments were similar.
6. The changes in blood pressure were similar even though the cardiac patients had a higher average blood pressure.
7. The subjective sensation of warmth for the cardiac patients was less on entering the hot room but became

greater by the end of the hour. The comfort vote, otherwise, was similar.

The results indicated that the observed responses of cardiac patients on exposure to sudden changes in environmental temperature were similar in most respects to those of young normal subjects. The few definite differences that did appear may represent differences which would have been observed as a result of the ageing process in relatively normal individuals.

Acknowledgment

The authors gratefully acknowledge the valuable assistance of Dr. Charles Gianasi.

HUMIDITY TEST APPARATUS

A humidity test apparatus[1], developed and built in the Mechanical Instruments Laboratory of the *National Bureau of Standards*, now makes available an instrument for research, calibration, and testing of hygrometers at temperatures below freezing. The humidity test apparatus was developed under the sponsorship of the Bureau of Ships, Department of the Navy, to provide an instrument for the investigation of radiosonde hygrometer elements at the temperatures and air velocities encountered during a fllight.

The function of the humidity test apparatus is to produce air of known relative humidity at temperatures from 0 C to — 40 C. In the new divided flow, low temperature humidity test equipment developed by Arnold Wexler, a current of dry air is divided into two streams, one of which is maintained dry while the other is saturated with respect to ice; finally the two are recombined.

A proportioning valve is used to divide the flow of moisture-free air in a known ratio. One part is passed through a saturator over a series of trays containing ice, until it is completely saturated. It is then mixed in a mixing chamber, with the other part that thas been maintained dry, and allowed to exhaust through a test chamber into the atmosphere. The saturator, mixing chamber, and test chamber are kept immersed in a constant temperature bath. The hygrometer or other device, which is being subjected to air of known and constant humidity, is inserted into the test chamber.

The relative humidity in the test chamber is a function of the fraction of air that passes through the saturator, the total pressure in the test chamber, the saturation pressure, and the partial pressure of the water vapor in the test chamber. Under ideal conditions, which the apparatus closely approaches, all variables except one are eliminated, and the relative humidity becomes equal to the fraction of air that passes through the saturator.

The essential functional units of the apparatus are the drying system, the proportioning system, the humidifying system, the mixing chamber, the test chamber, the cooling system, and the thermoregulating system for temperature control.

Drying System Removes Air Moisture

The drying system serves to remove all water from the air entering the apparatus by freezing in a dry ice-varsol bath. The dry air then passes through the proportioning system, the major feature of which is the proportioning valve. This valve, which divides the air in a definite ratio, consists of six orifices of equal cross-sectional area so arranged that by a turn of the knob of the valve the incoming air can be divided to produce any of seven ratios, 0, 1/6, 1/3, 1/2, 2/3, 5/6, and 1. The ratio is the fraction of air entering the valve that emerges through one exit channel.

The two air streams, upon leaving the proportioning system, flow through the humidifying system in parallel channels, thermally in contact with one another to allow heat interchange and temperature equilibrium between the two streams. Saturation of one stream is accomplished by allowing it to pass over a series of staggered ice-filled trays while the other stream passes over an identical path of dry shelves. The dry and saturated air are centrifugally mixed in a mixing chamber and discharged into the atmosphere through a $1\frac{1}{8}$ in. I.D. tube that serves as a test chamber. The saturators, mixing chamber and test chamber are immersed in a bath whose temperature is closely regulated.

The overall performance of the humidity test apparatus has been established by a series of gravimetric moisture determinations. For the temperature range of 0 C to —40 C and for air velocities up to 1500 fpm, this instrument produces air whose relative humidity is known within 3 percent.

While particularly suited for the investigation and calibration of hygrometers, psychrometers, and development apparatus at temperatures below 0 C, the humidity test equipment may find further application in general research and test-

[1]For further technical details, see Divided Flow, Low Temperature Humidity Test Apparatus, by Arnold Wexler. (*Journal of Research, NBS 40*, 479, 1948. RP1894.)

References

1. Physiological Adjustments of Human Beings to Sudden Change in Environment, by N. Glickman, T. Inouye, S. Telser, R. W. Keeton, F. K. Hick and M. K. Fahnestock. (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, July 1947, p. 101.)

2. Comparison of Physiological Adjustments of Human Beings During Summer and Winter, by N. Glickman, T. Inouye, R. W. Keeton and M. K. Fahnestock. (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, August 1948, p. 113.)

3. Nomenclature and Criteria for Diagnosis of Diseases of the Heart. (New York Heart Association, Inc., New York, 1946, 4th ed.)

4. Statistical Methods for Research Workers, by R. A. Fisher (Oliver and Boyd. Edinburgh and London, 1928, 2nd ed.)

5. New Tables for Testing the Significance of Observations. Student. (Metron, 5:105, 1925.)

6. On the Change in the Rectal Temperature of Man When His Body is Exposed to Extremely Cold Atmosphere, by R. Shoji and K. Ogata. (*Japanese Journal of Medical Science*, Biophysics, 6:85, 1939.)

7. Thermoregulatory Phenomena Associated with Exposure to Warm and Cold Environments, by J. D. Hardy and H. Goodell. (*Proceedings of the American Physiological Society*, 1947—In Press.)

ing where air of a known low dew-point or moisture content is desired. With such apparatus, devices placed in the test chamber can be subjected to discrete and almost instantaneous changes in relative humidity. Lag studies may therefore be easily made. The velocity of the air passing through the test chamber can be adjusted up to 1500 fpm.

Although this instrument was designed primarily to fill a basic need in meteorology, the refrigeration and air conditioning industries may also find it useful. In all thes[e] fields humidity plays an importa[nt] role. With the humidity test ap[pa]ratus it is now possible to calibrat[e] accurately and accurately the vari[ous] humidity measuring instrume[nts] employed at low temperatures.

Copies of the bulletin ca[n be] obtained from the Edison Elec[tric] Institute, 420 Lexington Ave[.,] New York, N. Y., at a small char[ge].

GROUND COIL FAVORED IN NEW ENGLAND HEAT PUMP TESTS

The results of two years' study are reported in a 48 page booklet, The Residential Heat Pump in New England, by Charles H. Coogan, Jr., professor and head of the dept. of mechanical engineering, University of Connecticut.

Begun in December 1946, the tests are a result of cooperation among various companies, and the work was carried on at the University at Storrs, Conn., under the direction of the author, who was assisted by five seniors in mechanical engineering.

The booklet presents data obtained from an experimental direct-expansion shallow ground coil heat pump system. Problems confronting the experiment included the New England winter and a need for information on the heat absorption characteristics of buried tubes. At the outset, emphasis was placed on acquiring such information. The cooling aspect of the heat pump was not taken into account because summer cooling was not considered a major factor in New England climate.

Soil Studied

Illustrated with diagrams, charts, micrographs and photographs, the booklet gives detailed studies of the properties of the soil and earth. The studies stressed thermal conductivity as an important property for the steady state of heat absorption, and for the transient state, two other factors, specific heat and density, were required. These three terms were combined in the designation: *Thermal Diffusivity.*

The effect of moisture content on other properties of the soil was important above and below freezing. Below freezing, heat of fusion of soil moisture was important under certain conditions. After one year's operation, portions of several tubes were uncovered and the soil around the tubes was analyzed for moisture content.

Thermal conductivity of the soil was determined both in the laboratory and in the ground around the buried tubes. Rejecting its first method, the research group reported consistent results with a brass canister filled with properly compacted soil and equipped with a thermocouple at the center.

A refrigerator compressor was used as the heat pump, its belt driven by a 1-hp—220 volt—60 cycle ac single phase repulsion-induction motor. Other materials and equipment included buried thermocouples, the refrigerant, expansion valves, insulated condenser, various meters, oil separators, traps and dryers.

Ground Coil Should Last

The conclusion of Professor Coogan is that the ground coil appears feasible and most favorable for use as a heat source for New England residential heating. Six feet seemed the most desirable depth, and according to the author, a properly installed and tested ground coil should last years without deterioration.

Analysis of local physical properties of the soil was emphasized. Moist soil was deemed superior to dry soil. One of the largest losses in the heat pump, the author states, was loss of energy in the driving motor, as well as loss in the compressor. A compressor with good modulating characteristics is, therefore, an important requisite. For the present, Professor Coogan concludes, the heat pump cannot profitably compete with many of the conventional systems now used for residential heating.

NORWEGIAN WHALER INSTALLS COOLING EQUIPMENT

The Thorshovdi, new Norwegian whaling vessel now headed for the Antarctic on her maiden voyage, was fitted out with refrigeration equipment after getting underway.

This was made possible because whaling ships have complete machine shops, and the equipment was installed by the Thorshovdi's own mechanics. The contract was handled by E. T. Anderson, representative in Norway of Carrier Corp., Syracuse, N. Y. The equipment includes a sea water ammonia compressor, auxiliary equipment and a complete set of spare parts.

COAL PRODUCTION INCREASED BY MACHINE

Increased coal production for possible synthetic liquid fuel was predicted with the demonstration of a continuous mining machine in Ohio recently.

This *mechanical mole* bored into a coal pit and produced high grade run of mine coal unaided by prior operations of drilling, cutting or blasting. Digging with a series of rotary chipping heads, the *Colmol*, a 26 ton machine, discharged coal into a shuttle car at the rate of about three tons a minute.

Coal authorities state that concentrated production and supervision hitherto unknown will be made possible by this machine. In addition, they said, a continuous mining machine may speed up construction of plants manufacturing liquid fuels from coal, and such fuel would add to the sources of low-cost electric power.

The Internal Performance of an Induced Draft, Packed Cooling Tower

By N. W. Snyder*, Berkeley, Calif.

SUMMARY — Measurements have been made of the variation of water temperature through the packed section of an induced draft, counterflow cooling tower. From these data the variation of air enthalpy and unit volume enthalpy conductances as a function of tower height were determined. It was noted that the point enthalpy transfer coefficients reached a maximum value approximately half way between the top and bottom of the packed section.

The relative percentages of water rates in the form of water film on the packing, water drops between packing slats and water film on the walls were measured to be 30, 30 and 40 percent, respectively.

Because of the complexity of the mechanism of evaporative cooling in packed cooling towers only overall characteristics have been obtained by the different experimenters[1-6]. The forced draft towers previously employed at the University of California were small and were placed indoors to insure steady ambient conditions. A larger tower was therefore constructed to facilitate more extensive and detailed study and attempts were made to equip the tower with instruments for obtaining information on the internal mechanism of cooling. The objective of the tests was to obtain the following items:

1. A determination of point enthalpy transfer coefficient per unit volume of tower $(h_t a)_x$, as a function of height in the packed section for various water rates and a constant air rate.
2. A comparison of the overall enthalpy transfer coefficient per unit volume of tower with its components due to the cooling of water drops, packing water films and wall water films.
3. A comparison of the overall enthalpy transfer coefficient per unit volume of tower (including cooling in the spray section and packed section), $(h_t a)_T$, and its components due to spray only, $(h_t a)_s$, and packed section only, $(h_t a)_p$.
4. A determination of the variation of the temperature of the water in the packed section as a function of the tower cross section and height for different water rates and a constant air rate.
5. A determination of the variation in mixed mean temperature of the water in the packing, on the walls and of the total water at different tower heights for various water rates and a constant air rate.
6. A determination of the distribution of water in the packed section in terms of the percentage of water film on the packing surfaces, water drops between packing slats and water film on the tower wall surface.
7. A determination of the pressure drop through the packed section for different water rates and a constant air rate.

Three groups of tests were run at approximately the *same air rate*. Some of the items in the foregoing objectives were not fulfilled because of insufficient data and are only briefly mentioned.

Description of Apparatus and Tests

Tower

The cooling tower was a mechanically induced draft, counterflow, packed or spray type tower. Fig. 1 shows the general arrangement of equipment for the tests and Fig. 2 shows a schematic diagram of the experimental arrangement.

Briefly, the cooling tower consisted of a vertical rectangular redwood tower 57 x 61 in. with double walled 1 in. x 6 in. wood siding which was removable on two opposite sides in 3-ft sections. The packed section was 152 in. high, with 33 decks of redwood packing, each of which consisted of 27 or 28 horizontal slats $\frac{1}{4}$ in. (base) x $4\frac{1}{8}$ in. (height) x 57 in. (length). The slats were staggered in alternate decks and the decks were mounted on 4 dowel pegs for ease of replacement. Below the packed section, air was admitted by means of four sets of louvers 2 ft high, one set on each side of the tower with each set shaped to direct the incoming air to the packed section without permitting

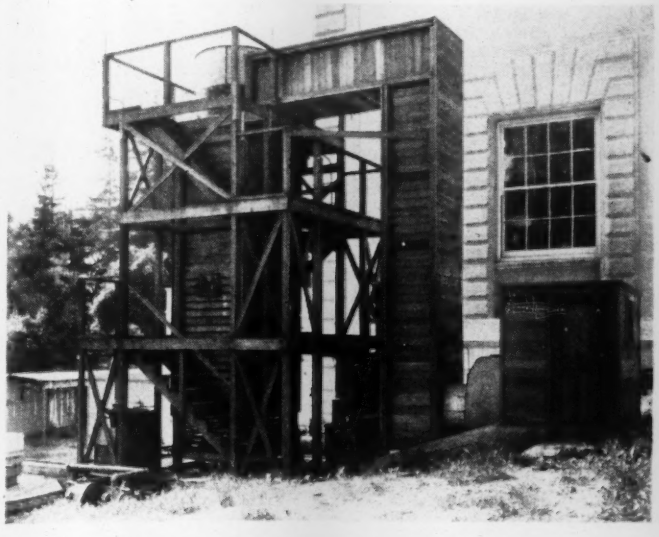

Fig. 1—Experimental cooling tower

*Assistant Professor of Mechanical Engineering, University of California.

[1] Exponent numerals refer to References.

Presented at the 55th Annual Meeting of the American Society of Heating and Ventilating Engineers, Chicago, Ill., January 1949.

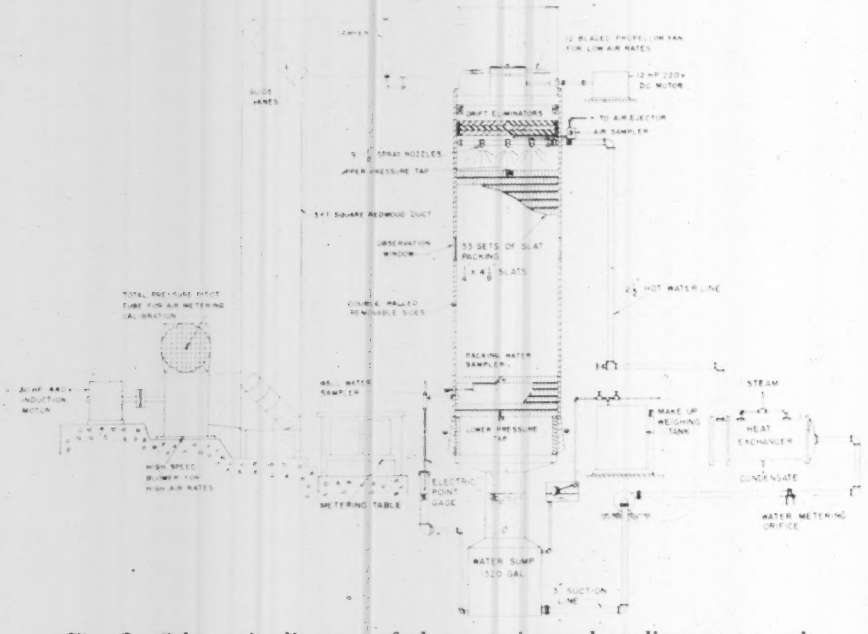

Fig. 2—Schematic diagram of the experimental cooling tower and instrumentation

loss of falling water from the system. Water circulation during a run was maintained in a closed system. A catch basin was placed at the bottom of the tower and connected to a sump tank which held approximately 1320 gal. The sump tank area was small at the normal water level in order to exaggerate the changes in observed water level due to losses from the system by evaporation or entrainment. A suction line connected to the bottom of the tank led the cooled-water to a circulating pump at ground level at one side of the tower. A metering orifice was placed between the pump and the shell-and-tube heat exchanger, which was heated by steam. From the exchanger the water was distributed to nine 1½ in. spray nozzles located 15 in. above the packing.

Water which was evaporated or entrained into the outgoing air was automatically replaced from a weighing tank, the flow of make-up water being controlled by a float valve to maintain a constant water level in the sump tank (see Fig. 2).

During the first two tests, air flow was established by means of a propeller fan located in the fan nozzle at the top of the tower and driven by a variable speed d-c motor. In the third test a duct was attached to the fan nozzle and connected to a high speed centrifugal fan. As shown by Fig. 2, air flow could be established by either the propeller fan or the centrifugal fan. The propeller fan was to be used for low air rates and the centrifugal for high air rates. It was found that the high speed centrifugal fan was unsatisfactory at low air rates due to pulsating flow when near the shut-off point. In future tests it will be only used for high air rates.

Measurements and Measuring Instruments

For the first two test groups, air rates were obtained by making a heat balance between the gain in enthalpy of the air and the loss in enthalpy of the known rate of water. An air rate for the third test group was obtained by drawing the air by means of a fan from the top of the tower through a 3-ft square wooden duct and a calibrated metering nozzle in which its velocity was determined. A calibrated orifice downstream from the centrifugal pump was used to meter the water.

Evaporation and entrainment rates were determined from the weighed make-up water plus the loss indicated by a change in the water level in the sump tank. An electric point gage was used to measure the water level.

Inlet water temperatures were obtained by means of four thermocouples connected in series and located in the spray nozzle manifold. A thermocouple was located in the sump tank in order to obtain exit water temperatures. Seven removable thermocouples were located from the bottom to the top packing deck in order that a traverse of water temperature with height and cross section could be obtained. It was realized that the temperature distribution of the water over the cross section might vary in different directions, but the best that could be done at the time was to obtain a traverse along only one center line. Thermocouple emf's were obtained by means of a potentiometer readable to 0.005 mv. The potentiometer was mounted on a metering table placed upon a concrete slab away from the cooling tower in order to eliminate vibrations.

The pressure drop in the tower was measured with an electric point gage micromanometer readable to 0.0002 in. of water. This instrument was also placed on the metering table. The pressure taps were located at either end of the packed section and in the center of the packing deck. The tap consisted of two concentric cylinders with the annulus closed on the ends. Holes were drilled on the inner cylinder and a pressure tap was led from the outer cylinder wall to a water trap and then to the manometer. Another line was led from the bottom of the outer cylinder wall to the water trap in order to drain water caught in the pressure tap annulus.

Inlet air wet bulb and dry bulb temperatures were determined by four thermocouple psychrometers, one located at the center of each intake louver. Readings were taken separately and averaged at a later time. An air sampler was used to determine outlet air wet bulb and dry bulb temperatures just beyond the sprays. A thermocouple psychrometer located downstream from the propeller fan was used as a check.

The air sampler was constructed from two tinned cans, one within the other. Air from the tower was led into the outer can over a baffle, acting as an entrained-water scrubber, then into the inner can over the wet and dry thermocouples. Air from the inner can was evacuated by means of an air ejector. The outer can was thoroughly insulated. This method yielded a measurement at only one point in the cross section. It is realized that the non-uniformity of the temperature of water would cause some non-uniformity of the exit air conditions. The exit air conditions, as measured, were not considered to be as accurate as desired.

The distribution of the total water in the tower between the falling water drops, the film on the packing and the film on the tower walls was determined by means of a packing water catcher and a wall water catcher. The packing water catcher was shaped into a long rectangular trough with a false bottom. The lower chamber was divided longitudinally into two enclosures. The upper chamber was open at the top but was partitioned crosswise by means of bulkheads. These bulkheads were spaced in such a manner as to catch packing water in one space and water drops in the other when placed just beneath a packing deck. By punching holes in the false bottom partition in such a way so as to lead only water drops between the packing slats into one of the lower longitudinal chambers and slat film water into the other, it was possible to collect each of these separately and conduct the water to the outside of the tower by means of two rubber hoses connected to each of the lower chambers. The wall water catcher consisted merely of a flat trough, fastened to the tower, and draining through a pipe to the outside of the tower.

Tests Conducted

Tests were conducted in three groups referred to as Test Group 1, Test Group 2 and Test Group 3. The actual test results are not shown in this JOURNAL, but will be published with the complete report. Test results and computed values will, however, be found in Figs. 3 to 8.

Data and Computations

Evaporated and Entrained Water

The measurement of make-up water by means of the make-up weighing tank and sump tank level yielded the sum of the evaporated and entrained water. Evaporated water could have been obtained only if it were possible to measure the entrained water. Because this measurement was not possible, the total make-up water was construed to be equal to the evaporated water. A small amount of entrained water was observed leaving the tower. It was also noted that the entrainment increased sharply at an air flow rate of approximately 5000 lb per (hour) (square foot of net cross section area of packing). For an 8 millimeter water drop formed at the bottom of a slat, the corresponding Reynolds number would be approximately 2800. According to Nottage and Boelter[2] a Reynolds number of about 4000 is needed to suspend the drop. For the smaller drops, the previously mentioned air loading (air flow rate) would entrain drops smaller than 2 millimeters.

Water Distribution

The water draining off the packing as film, and that falling between packing in drops, or that draining off the wall as film was collected separately to obtain the rate per hour for each. The total drained off the slats as film was obtained by multiplying the weight collected from a portion of the slats by the ratio of total slat length to this portion.

It was found that the sum of the

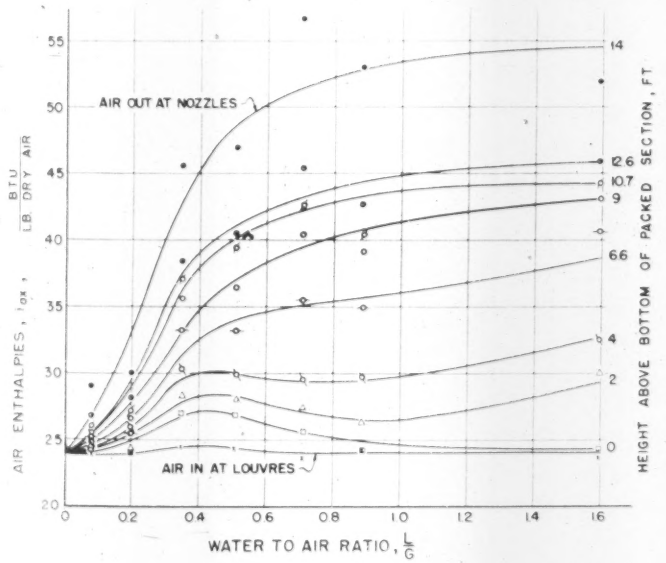

Fig. 3—Variation of air enthalpy with water-to-air ratio at various heights

Air rate = 67,000 (± 19 percent) lb per hour.
Data from Test Group 2.

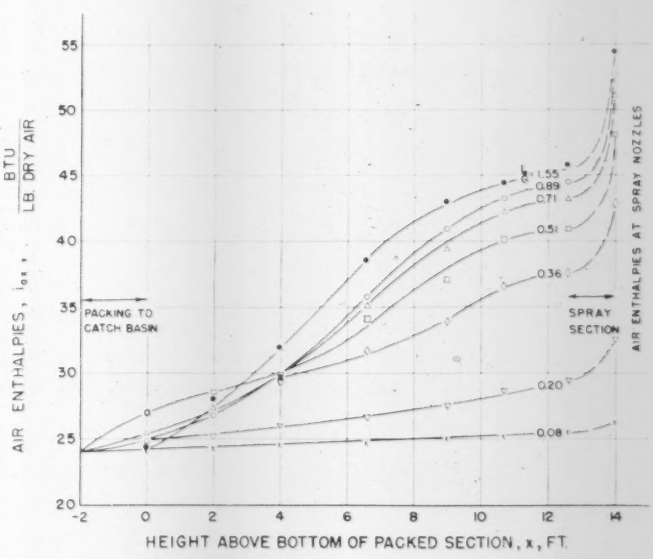

Fig. 1—Relation of air enthalpy to height for various ratios of *L/G*

Air rate = 67,000 (± 19 percent) lb per hour.
Data from Fig. 3.

three water quantities obtained in this manner was greater than the quantity determined by means of the metering orifice. Each of the three quantities was therefore decreased in the same ratio so that the total equalled the metered quantity.

Air Enthalpies

Air enthalpies at various heights of the tower were not obtained from the actual wet and dry bulb temperatures. The measurement of wet bulb and dry bulb temperatures of a sample of air which is surrounded by water drops requires that the measuring device be protected from these drops of water. When a sample is obtained by passing the air through a tube to the outside and then through a separator in order that any entrained water drops be removed, it is evident that the walls of the device would be wetted and thus cause a change in enthalpy of the sampled air. Because of the small amounts of water involved, any correction would be difficult to obtain. An instrument for making an accurate measurement of the air condition inside the tower has not been devised as yet.

Measurements which could readily be obtained inside the tower were the water temperatures; of these, a traverse was obtained along a center line of the packing at various heights in the towers. Wall water temperatures were also measured at the same height. By using the previously measured water distribution of wall water and packing water, a *mixed mean temperature* at each level was computed. The temperature of the water which fell into the basin was also measured. By knowing the total water rate and temperature differences between successive levels in the tower, an enthalpy change was calculated between these successive positions from the sump to the nozzles. Since the wet and dry bulb temperatures of the incoming air were also measured, successive values of the air enthalpy were obtained by equating the changes in water enthalpy to the changes in air enthalpy. The changes in enthalpy between these stations were weighted so that the sum of these increments equaled the total change in enthalpy throughout the tower.

Enthalpy Transfer Coefficients

With the mean water temperature and the air enthalpies at various heights in the tower calculated, a transfer coefficient was obtained between successive heights. An energy transfer equation between two successive stations in the tower may be written as,

$$L\,C_{pw}\,(\Delta t)_x = (h_t a)_x\,V_x\,(\Delta i_x)_m \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where

L = water rate, pounds per hour.

C_{pw} = specific heat of water, Btu per (pound) (Fahrenheit degrees).

$(\Delta t)_x$ = temperature increment between two successive heights in the tower, Fahrenheit degrees.

x = height above the bottom of the packed section to halfway between the successive stations considered, feet.

$(h_t a)_x$ = point enthalpy transfer coefficient per unit volume of tower, Btu per (hour) (cubic foot) (Btu per pound of dry air).

a = surface area through which energy is transferred per unit volume in the volume included by $(\Delta t)_x$, square feet per cubic foot.

V_x = volume of tower included between the two successive temperature stations considered, cubic feet.

$(\Delta i_x)_m$ = integrated mean enthalpy potential difference[4] between the two successive temperature stations in tower, Btu per pound of dry air.

Note that a was not separated from h_t even though a set of packing was used for which the surface area was known. It will be shown that a considerable portion of the falling water in the tower was in the form of an aggregation of various sized drops for which the surface area was not known. This fact is true for all packed cooling towers where there is an interchange between film and drop formation.

Further study on the effect of the percentage of water in the drop form and that in the form of jets on unit volume enthalpy transfer coefficients was considered necessary. Work is now being carried out by the author to fulfill this need.

Along with the calculation of a point transfer coefficient was the determination of an overall transfer coefficient for the whole packed section and the spray section only. With the enthalpy changes of the water for the packed section and the spray section known, the following quantities were found in the same manner as indicated by Equation 1:

$(h_t a)_p$ = overall enthalpy transfer coefficient per unit volume for the packed section, Btu per (hour) (cubic foot) (Btu per pound of dry air).

$(h_t a)_s$ = overall enthalpy transfer coefficient per unit volume for the spray section, Btu per (hour) (cubic foot) (Btu per pound of dry air).

Pressure Drop

A small amount of air pressure drop data was obtained for the packed section. No correlation was attempted due to the fact that too few data were taken.

Discussion

Energy Distribution

It was noted that a plot of the air enthalpy, i_{ax}, as a function of height in the tower, x, and of the ratio of water to air rate, L/G, served to represent the energy distribution through the tower better than the temperature of the water. During the tests, values of air enthalpy at the entrance to the tower, i_{a_1}, did not vary by more than three percent for all runs during a given night. A first attempt was made by plotting the enthalpy of the air at a given height in the packed section, i_{ax}, *vs* x with L/G as a parameter, where L was the water rate and G the air rate. In doing so, it was found that some of the experimental points were erratic and caused some confusion. By plotting i_{ax} *vs* L/G with x as a parameter, the various curves fell into a reasonable

order (see Fig. 3 for Test Group 2). By obtaining points on the faired curves of Fig. 3 of i_{ax} *vs* L/G and x, a crossplot was made, see Fig. 4.

It can be noted in Fig. 3 that at an approximate value of $L/G = 0.4$ there was a sharp decrease in i_{ax} for all values of x as L/G was decreased. Although G was maintained at approximately 67,000 lb per hour for these runs, L/G was varied by varying the water rate, L, from 95,500 lb per hour to 6500 lb per hour. It was realized that between the water rates of 95,500 and 0 lb per hour there would be a transition region from completely wetted to completely dry packing which would be called a partially wetted packing region. In this region there occurs channeling of the water streams on the packing and a consequent loss in cooling effectiveness. The variable L/G was not considered very significant in describing the transition from a fully wetted to a partially wetted packing because G can be changed for a given value of L and still not change relative wetting.

A better variable than L/G for the packing loading would be a quantity which would take into account the water spreading characteristics of the packing. This may perhaps be in part described by the ratio, blocked cross sectional area to the gross cross sectional area, or by the surface area of the packing for a foot of length of tower per open or net cross sectional area of the tower. In order to prevent the variable from approaching infinity when the packing density approaches that of a spray tower (zero packing surface area), a ratio of slat film water rate to drops water rate was used. This variable to be used in the correlation of results from various towers might be:

$$\frac{L\left(\frac{w_s}{w_d}\right)\left(\frac{A_c - A_n}{A_g}\right)}{S} \quad \ldots\ldots (2)$$

where

S = total surface area of packing in tower, square feet.

A_n = net or open cross sectional area of packed section, square feet.

A_g = gross cross sectional area of tower, square feet.

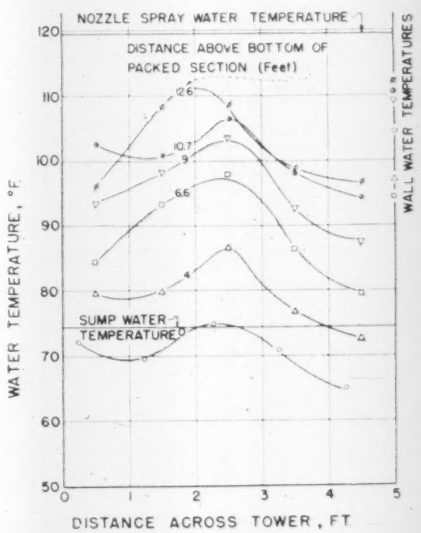

Fig. 5—Typical temperature distribution for cooling tower
Temperature measured along center line.
L = 32,500 lb per hour
G = 63,000 lb per hour
Inlet air 60 F dry bulb, 57 F wet bulb.

$$\frac{w_s}{w_d} = \frac{\text{water film drained off packing slats, pounds per hour}}{\text{water flow in drops between slats, pounds per hour}}$$

As the density of packing decreases, both area A and the ratio of the film to drop water rate w_s/w_d decrease until the limiting case of a spray tower is reached in which case S and w_s/w_d become zero and

$$\frac{L\,w_s}{w_d}\left(\frac{A_c - A_n}{A_g}\right)$$
$$S$$

does not have a singularity. The value of

$$\frac{L\left(w_s/w_d\right)\left(\frac{A_c - A_n}{A_g}\right)}{S}$$

becomes

$$(67000)\ (0.4)\ \frac{1.11\left(\frac{24.2 - 20}{24.2}\right)}{2880}$$

$$= 17.9 \text{ lb/(hour) (square foot)}$$

for the present experimentation at the point referred to previously on Fig. 3 where partial wetting begins. In the case of the experimental data presented by London, Mason and Boelter[1], the value of $\frac{L(w_s/w_d)\,[(A_c - A_n)/A_g]}{S}$ is 3.8 lb per (hour) (square foot) for the critical point of wetting they reported. The quantity w_s/w_d was assumed to be about 1.0 for the London, Mason and Boelter data. Comparison of the two values shows that the present method of determining the critical point yields a value five times the value obtained by the former group. It is believed that the step made in trying to correlate the critical points of the two towers, even with seemingly negative results at present, should lead toward a more complete understanding of the correlation of other desirable tower variables.

Water Temperature Distribution

Observing Fig. 5, which represents a typical set of data, it was found that the water temperatures near or at the center of the tower were 5 to 20 deg higher than those near the sides. Higher temperatures may be expected near the center if the water rates are more concentrated there and also if the air velocities are higher toward the sides. In experiments now being conducted the wall water is being eliminated near the top of the tower as much as possible in order that its effect be removed.

The wall water temperatures decreased by only 40 percent of the total of the water temperature change in the packing because of the lack of stirring, splashing and surface area during its descent. The first is equivalent to a high water side resistance to heat transfer.

Fig. 5 shows that the average water temperature at the bottom of the packed section was lower than that of the sump. However the wall water existed at a much higher temperature at this point, 95 F as compared to 70 F, therefore the mixed mean temperature of the packing water plus the wall water yielded the sump water temperature of 74.5 F after corrections were made for the cooling by the air between the bottom of the packing and the catch basin. Fig. 6 shows wall water temperatures as a function of height for Test Group 3.

Water Distribution

From the data which were obtained for the three Test Groups at

different times, the percentage of wall water, slat water, and water drops between slats varied somewhat. The results were averaged and yielded the following data:

Test Group	Percent Water Rates Wall	Slats	Drops
1	40	25	35
2	41	31	28
3	28	32	40
Av'g. of 1, 2, & 3	36	30	34
Av'g. of 1 & 2	40	28	32

The slat and drop water data were obtained at one place in the tower with the wall water in a separate device but all results were corrected so that the sum of the three quantities equaled the total measured water rate. Since the average results given in the last two rows were similar, it may reasonably be concluded, for the present, that the water rate distribution was approximately divided in percent as follows: wall water = 40; packing slat film water = 30 and water drops = 30.

Of the water in the packed section only, an equal division between drops and slat film occurred. It is not justified, therefore, to assume that the surface area of heat or mass transfer is only the packing surface area as was done in the work presented by London, Mason and Boelter[1], because up to half the water in the tower at any particular time was not in the form of packing film water. Transfer coefficients should then be reported as $h_t a$ and not h_t which is based only upon a packing surface area. Even though the ratio of water rate by drops to water rate as packing film may remain constant, the surface area of water drops to packing film will increase with total water rate.

Research and analysis is now being carried on to show the relative importance of water drop cooling to the packing film cooling. This will be illustrated by not only making a microscopic analysis on the individual water drop and film, but also by varying the density and types of packing. The latter will serve to change the performance of the tower by causing different heights of fall of the water drops and also different drop size distributions due to splashing.

Point Enthalpy Transfer Coefficient per Unit Volume

Point enthalpy transfer coefficients per unit volume are shown plotted as a function of the position x which is measured above the bottom of the packed section at points halfway between the water temperature movable thermocouple stations. Data for Test Group 3 were used in drawing Fig. 7. Fig. 7 showed the tendency of point conductances to be highest approximately halfway up the packed section.

It has been noted in the heat transfer from tube walls to fluids flowing into and through a tube that the point transfer coefficients were high at entrances because of the fluid flow conditions. Uniform velocity distributions at the entrance which change into turbulent or viscous velocity distributions further into the tube were found to be the cause. Water and air distributions in the cooling tower were far from being uniform. Air entered the tower by making a right angle turn and water entered from nine individual sprays. The same conditions as mentioned for point transfer were not found in the cooling tower but it is believed that velocity distributions were the cause of the varying transfer coefficients shown in Fig. 7. It might be guessed that the point transfer coefficients should be higher at the water entrance side of the packing because the water temperatures were higher and air flow more uniform. But in observing the water sprays some time after tests were made, it was noted that water was not evenly distributed on the packing because of the sheet like characteristics of the nozzle spray. It may be concluded that the water distribution at the spray end of the packing was uneven and therefore would not be conducive to high transfer coefficients. Lower point transfer coefficients at the ends of the packed section were probably caused by the non-uniform distribution of air and water at the respective entrances.

Further experimentation should attempt to verify these results and eliminate or correct for the end conditions mentioned. For the case of water distribution, a set of screens may be used just after the

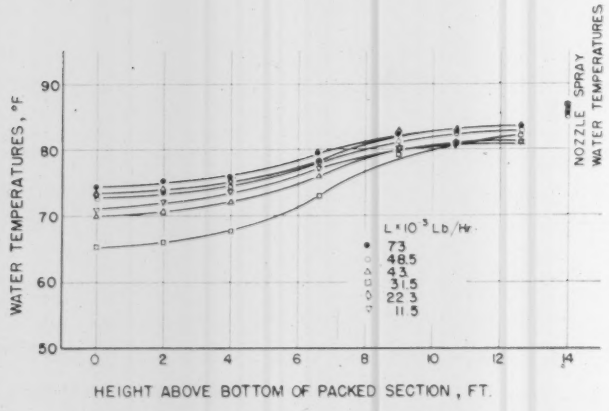

Fig. 6—Wall water temperatures as a function of height
Air rate = 76,800 (± 11 percent) lb per hour.
Data from Test Group 3.

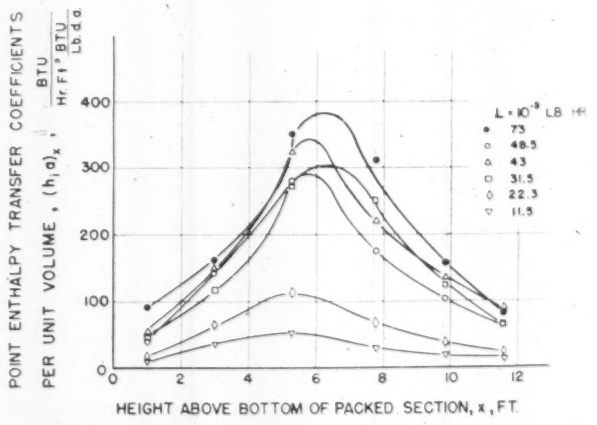

Fig. 7—Point enthalpy transfer coefficient per unit volume as a function of height in packed section for various values of L
Air rate = 76,800 (± 11 percent) lb per hour.
Data from Test Group 3.

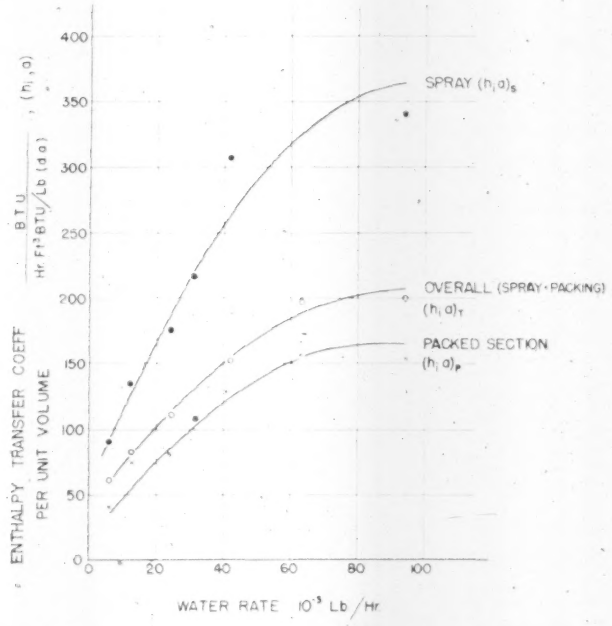

Fig. 8—Overall enthalpy transfer coefficient per unit volume

Comparison between spray and packed section performance. Air rate = 67,000 (± 19 percent) lb per hour. Data from Test Group 2.

sprays in order that the water drops be spread more evenly. Air flow conditions at entrance should be measured before specific conclusions are made. If a non-uniform air flow exists, there would be great difficulty making corrections with the present tower. A long calming section would be needed to obtain uniform entrance conditions. Certain end conditions simulating commercial operating tower conditions are, however, desirable.

Overall Transfer Coefficient per Unit Volume

In order to make a comparison between the cooling due to the spray between the nozzles and packing and the cooling due to the packing, an overall unit volume transfer coefficient was calculated for each part respectively. Fig. 8 shows results for Test Group 2 for which overall unit volume conductances for the spray section, packed section and spray and packed section were plotted *vs* the water rate with the air rate being fairly constant for all runs.

Enthalpy transfer coefficients per unit spray section volume as shown in Fig. 8 were from 200 to 230 percent greater in magnitude than the unit volume transfer coefficients for the packed section only. Note the sharp increase in enthalpy of the air for this data as shown in Fig. 3 at the various water rates.

Drops falling in the spray section were traveling at high velocities and existed in a high state of agitation after breaking from the turbulent sheets of water near the spray nozzle tips. Drops formed at the bottom of packing slats fell from a zero initial velocity and a relatively quiet state of agitation as compared to the spray drops. Two effects of heat transfer in falling water drops are noteworthy:[7,8]

1. Heat transfer from drops to air increases with the relative velocity of the drops to the air.
2. Liquid side resistance to heat transfer from drops reduces with increased convection or agitation within the drops.

With these considerations, conductances may be expected to be higher in the spray section and this was verified by the data plotted in Fig. 8.

An overall unit volume transfer coefficient was calculated for the whole tower, spray plus packing, and is also shown in Fig. 8. It may be seen that this curve is closer to the packed section curve which is explained by the fact that the volume of the packed section was approximately ten times that of the spray section.

Components of Packing Cooling Due to Drops, Slat Film and Wall Water

An attempt was made to obtain data in order that computation could be made for the difference in cooling in the packed section due to drops and that due to slat films, by utilizing water temperature measuring devices which segregated the two forms of water. Film temperatures at the bottom of each slat were found to be up to 1 deg higher than the adjacent drops. Of the data taken, none were representative enough to correlate with the other results.

Pressure Drops

Only a small amount of pressure drop data was obtained along with the heat transfer data. Since the groups of test runs were made at essentially constant air rates and because pressure drops vary with the square of the air rates, no extensive correlation could be made.

With the data obtained in Test Group 2, it was found that pressure drops varied from 0.2 to 0.35 in. of water for a variation of water rate from 6500 to 95,500 lb per hour when the average air rate was 67,000 lb per hour. A friction factor, calculated from these results by the use of the Fanning equation,

$$\frac{f\,L}{R}\,\frac{u^2}{2g} = \Delta p \qquad (3)$$

where

f = friction factor.
L = length of packed section, feet.
R = hydraulic radius (open cross sectional area / perimeter of packing slats in one deck), feet.
u = mean air velocity through packing, feet per second.
Δp = pressure drop of air through packed section, feet of air.

varied from 0.40 to 0.70 respectively. The Reynolds Number was approximately 50,000 based on an hydraulic radius of the net cross sectional area.

Conclusions

1. Air enthalpies decreased sharply with water rates at all positions in the packed section for value of L/G from 0.35 to 0.4 indicating a possible critical point for partially wetted packing.

2. The water temperatures over any cross section in the packed section were maximum approximately midway between the tower sides. Values were found to be from 5 to 20 deg higher than those near the sides.

3. The temperature of the water film on the walls was found to decrease by only 40 percent of the decrease in temperature of the packing water over the height of the packed section.

4. The total water flowing was found to be divided between the film on the walls, drops between packing slats and film on the packing slats in percent as follows: wall water film = 40; water drops between packing slats = 30; water film on packing = 30.

5. The point enthalpy transfer coefficients per unit volume, $(h_1a)_x$, were maximum approximately halfway between the ends of the packed section.

6. Overall enthalpy transfer coefficients per unit volume of the spray section above the packing were from 185 to 235 percent greater than for those in the packed section. Overall enthalpy transfer coefficients per unit volume were found to vary from 85 to 360 Btu per (hr) (cu ft) (Btu per lb dry air) for the sprays and 40 to 160 Btu per (hr) (cu ft) (Btu per lb dry air) for the packing over a water rate range of 6500 to 95,500 lb per hr. Air rates remained approximately 67,000 lb per hr ± 19 percent for all runs.

7. For the range of water flow of 6500 to 95,500 lb per hr and an average air rate of 67,000 lb per hr, the pressure drops varied from 0.2 to 0.35 in. of water respectively. Correspondingly, the computed Fanning friction factors were found to vary from 0.40 to 0.70. The Reynolds Number for air was approximately 50,000 based upon an hydraulic radius of the net cross sectional area.

Nomenclature

A_g = gross cross sectional area of tower, square feet.

A_n = net or open cross sectional area of packed section, square feet.

a = surface area of energy transfer per unit volume of tower, square feet per cubic foot.

C_{pw} = specific heat of water, Btu per (pound) (Fahrenheit degree).

h_1 = unit enthalpy conductance, Btu per (hour) (square foot) (Btu per pound of dry air).

$(h_1a)_p$ = overall enthalpy transfer coefficient per unit volume of packed section, Btu per (hour) (cubic foot) (Btu per pound of dry air).

$(h_1a)_s$ = overall enthalpy transfer coefficient per unit volume of spray section, Btu per (hour) (cubic foot) (Btu per pound of dry air).

$(h_1a)_T$ = overall enthalpy transfer coefficient per unit volume of spray and packed section, Btu per (hour) (cubic foot) (Btu per pound of dry air).

$(h_1a)_x$ = point enthalpy transfer coefficient per unit volume at height x, Btu per (hour) (cubic foot) (Btu per pound of dry air).

g = gravitational acceleration, feet per (second) (second).

G = air rate, pounds per hour.

i_{ax} = enthalpy of air in tower at height x, Btu per pound dry air.

$(\Delta_{ix})_{lm}$ = log mean enthalpy potential difference between two successive temperature stations in tower, Btu per pound of dry air.

Δp = pressure drop of air through packed section, feet of air.

L = water rate, pounds per hour.

R = hydraulic radius = $A_n \div$ perimeter (feet) of packing slats in one deck.

S = total surface area of packing in tower, square feet.

$(\Delta t)_x$ = temperature increment between two successive heights in tower, Fahrenheit degrees.

u = mean air velocity through packing, feet per second.

V_x = volume of tower included between two successive heights in tower, cubic feet.

w_s = water rate as film on packing slats, pounds per hour.

w_d = water flow between slats in the form of drops, pounds per hour.

x = height above bottom of packed section, feet.

f = friction factor defined by the Fanning equation.

Acknowledgment

Plans for the tower were originally made by L. M. K. Boelter, E. D. Howe, and D. D. Davis. Messrs. C. Miller, H. Eagles, and J. D[illegible]sta assisted in construction of the tower. Greatly appreciated were the experimental assistance of M. Greenfield, B. G. Case, C. H. [illegible]ley, H. Ast, D. Billings, B. Mahin and F. McInerney. Mr. Greenfield was of great assistance in the collation and computation of the data. Guidance was extended by L. M. K. Boelter and E. D. Howe.

The cooperation and interest of the American Society of Heating and Ventilating Engineers and the Cooling Tower Institute was appreciated. The redwood for the tower was a gift of the Redwood Manufacturers Co., San Francisco, through the help of E. Simons. Five sets of spray nozzles and a propeller fan were gifts of the Marley Co., Inc., Kansas City, through L. T. Mart. The high speed blower was loaned by W. R. Ames Co., San Francisco.

References

1. Performance Characteristics of a Mechanically Induced Draft, Counterflow, Packed Cooling Tower, by A. L. London, W. E. Mason and L. M. K. Boelter. (*ASME Transactions*, Vol. 62, 1940, p41.)

2. Verdunstungkuhlung, by F. Merkel. (*V. D. I., Forschungsarbeiten*, No. 275, 1925.)

3. Untersuchung und Berechnung von Kwhlwerken, by J. Koch. (*V. D. I. Forschungsheft*, No. 404, 1940.)

4. Spray Nozzle Performance in a Cooling Tower, by L. M. K. Boelter and S. Hori. (ASHVE Transactions, Vol. 49, 1943, p309.)

5. Design and Performance of Cooling Towers, by W. K. Hutchinson and E. Spivey. (*Inst. of Chem. Engr.* (British), Vol. 20, 1942, p42.)

6. Performance of Small Mechanical Draft Cooling Towers, by W. M. Simpson and T. K. Sherwood. (*ASRE Journal*, December 1946.)

7. Dynamic and Thermal Behavior of Water Drops in Evaporative Cooling Processes, by H. B. Nottage and L. M. K. Boelter. (ASHVE Transactions, Vol. 46, 1940, p41.)

8. The Cooling of a Freely Falling Water-Drop by N. W. Snyder. (University of California, *Ph.D. Thesis*, 1947.)

Summary of Local Chapter Meetings*

Atlanta—December 2, 1948. Pres. Lewis L. Barnes presided at the annual social meeting held in the dining room of Harris', Inc. President Barnes introduced newly elected officers who are: Leo Sudderth, Jr., *President*, Ralph L. Beach, *Vice President*, Frank A. Player, *Secretary*, Frederick W. Bull, *Treasurer*, and Lewis L. Barnes and Charles V. Fenn, *Governors*.

President-Elect Sudderth made a short acceptance speech and announced committee chairmen for the coming year as follows: Frederick W. Bull, *Finance*, Harry L. Baker, Jr., *Program*, Everett T. Gorbandt, *Membership*, Jack G. Croley, *Attendance*, Walter M. Garrard, *Social and House*, George B. Hightower, *Hospitality and Acquaintance*, H. King McCain, *Research*, Spencer Boyd, *Codes*, and Richard H. Yancey, *Publicity*. After a short intermission, the remainder of the evening was given over to the enthusiastically received Great Torrini, magician and showman. Attendance 42. Attendance ratio 0.40.

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Central New York—December 8, 1948. The meeting was called to order by Past Pres. Carl F. Woese at Howard Johnson's restaurant, at 8:15 p. m. Program Chairman Leo E. LaRow reported that the next meeting would be held in Syracuse on Wednesday, February 16, at Howard Johnson's restaurant, and that Harold A. Lockhart would speak on the subject, *Hot Water Systems*. William H. Driscoll, past president and life member, introduced Dean Lauren E. Seeley, treasurer of the Society, who spoke on *What Kind of Society Do We Want?* His analysis of the Society's activities brought forth a stimulating discussion. Attendance 32.

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Central Ohio—December 20, 1948. A city code covering heating and air conditioning was the subject of the talk given by R. S. Curl at the Chapter gathering in the Chittenden Hotel. Mr. Curl, consulting mechanical engineer and treasurer of the Chapter, has been delegated by the City of Columbus to draw up the code.

Mr. Curl stated that the code should be mainly concerned with safety but that it should also help to eliminate irresponsible contractors.

Three separate divisions of the code are planned with three licenses to cover these divisions: (1) Warm air, including forced and gravity installations; (2) Steam and hot water, both gravity and forced; and (3) Air conditioning, including refrigeration.

Mr. Curl stated that wherever it is possible, national authorities will be referred to. The Society's HEATING, VENTILATING AND AIR CONDITIONING GUIDE will be the authority for figuring heat loss and for other items within its scope. For the code pertaining to warm air installation, the authority will be the *National Warm Air Heating and Air Conditioning Association*. For refrigeration installation, the *American Standards Association* will be the reference. Other points discussed by Mr. Curl were: the relationship of cooling systems to heating systems, location of heating plants, accessibility to heating plants or main control valves, fire hazards of filters, outside air intake, cooling towers, kitchen exhausts, and radiant heating.

A lively question and answer and open discussion period followed. The consensus was that it would be very desirable to use current editions of accepted material, such as THE GUIDE, as references.

President William M. Myler, Jr. presided over this meeting. The Executive Committee announced the nomination of Newton T. Hess to fill the vacancy created by the death of M. R. Hamlin. President Myler was elected Chapter Delegate, and Vice President E. A. Norman, Jr. was elected Alternate to represent the Chapter at the Chicago Meeting. Attendance 33.

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Cincinnati—November 9, 1948. At the short business session of the dinner meeting in the Engineer's Club, Carson D. Weaver announced that Leon L. Kuempel, a Society member, would speak on Vehicle Air Conditioning at the Chapter's December meeting. Arno Gerdsen then reported December 14 as the date for the Stag Xmas Party, and March 12, 1949 as the date for the Ladies' Dinner Dance, both events to be held at the Kemper Lane Hotel.

The business meeting was adjourned and Marvin Mathewson introduced Alfred E. Stacey, Jr., first vice president of the Society and process consultant of Carrier Corp., Syracuse, N. Y. Mr. Stacey spoke on *Engineering and Economic Mobilization*, a subject that gave the membership an insight into the tremendous task of supplying materials and equipment for World War II. Mr. Stacey also gave a resumé of the early history of our Society. Attendance 37.

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Delta—December 14, 1948. Vice President Ross B. Guest, presiding over the regular monthly meeting at the New Orleans Athletic Club,

* Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

read a letter from Reg. F. Taylor, chairman of ASHVE Chapter Relations Committee, which covered the subject of Society membership and membership applications.

Introduced by John J. Bryner, the speaker was Henry Sleik, vice president of the W. B. Connor Engineering Corp., New York City. His subject was *Odors—Their Nature, Cause and Control.* His informative talk was highlighted by the use of slides and by a demonstration of odor adsorption.

Music during the dinner and after the talk was provided for by the Entertainment Committee. Attendance 32.

Delta—November 9, 1948. G. L. Tuve, president of the Society, spoke on *The Engineer as a Professional Man* at the regular monthly Chapter dinner meeting held at the New Orleans Athletic Club. He discussed possible developments and advances in heating and ventilating, and the engineer's place in this progress.

Chapter delegate elected by acclamation was John S. Burke, and James S. Adair was elected alternate. Reporting for the technical papers committee, Mr. Burke announced that Bruce A. Jacobi, chief engineer for the Lerner Stores, would speak on *Chain Store Air Conditioning* at the chapter's joint meeting with the *Louisiana Engineering Society* in January. Mr. Burke also read a letter from C. R. Gardner, chairman of chapter delegates for ASHVE, requesting subjects for the agenda of the Chapter Delegates meeting at the coming Annual Meeting.

Membership Committee Chairman Walter G. Grant, Jr., gave a report on applications of prospective members. A letter from the local chapter of the *National Association of Practical Refrigeration Engineers* was read by Pres. L. V. Busenlener. The letter invited the Chapter's attendance at their national convention. Attendance 29.

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Golden Gate—December 2, 1948. A combination of Ladies Night, Past-Presidents' Night and a Christmas Get-Together was held in the Engineers Club. The following past presidents were introduced: Baldwin M. Woods, G. M. Simonson, John F. Kooistra, Rolfe A. Folsom, Robert B. Holland, James Gayner, and Fred W. Kolb. Clarence L. Peterson was represented by his wife. Neil H. Peterson and Clyde E. Bentley were unable to be present.

President Herbert V. Hickman turned the meeting over to the program chairman, Karl Baldwin. Mr. Baldwin then introduced, as master of ceremonies, Baldwin M. Woods, the Chapter's first president.

The varied program included music, games, and two movies giving interesting pictures of California and the United States.

Santa Claus appeared and distributed Past Presidents' pins to the past presidents attending. Santa then gave candy canes to the other members and guests. A musical interlude, presented by George Walker and Dow Stone, included community singing. At the end of the program, a mysterious piano player broke in with some more popular music. (It was discovered she was one of the guests.) Attendance 99.

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Illinois—November 13, 1948. Harold F. Stamps, chairman of the Membership Committee, introduced new members, and out-of-town guests were introduced by M. J. Bamond, member of the receiving committee.

A proposed amendment of the Municipal Code of the City of Chicago was the subject of the report of the Legislative Committee. Read by O. J. Prentice, the report quoted a letter from the *Western Society of Engineers.* This amendment suggests that no plans be approved for building construction unless stamped by an architect or engineer licensed in accordance with the Illinois State Engineering act. The membership voted in the affirmative.

After the business meeting, Clyde W. Colby, Whitewater, Wis., was introduced by Roy W. Shields, member of the Meetings Committee. Mr. Colby, who is associated with the A. O. Smith Corp., explained his firm's experience with heating installations in homes built for employees. These homes used panel heating systems, and in one of these buildings the heat pump was used. With slides Mr. Colby illustrated and compared many types of heating systems such as steam radiator, warm air, convector, and finally radiant systems.

He described an installation in Pennsylvania in which the normal heat loss seemed unusually high. Upon investigating, engineers found a spring under the house. The spring was absorbing more heat than the boiler capacity. Mr. Colby recommended thereafter that insulation be installed under the basement floor where such a possibility might exist.

One high point of the evening was Mr. Colby's description of the A. O. Smith plant at Kankakee, Ill. The building, he pointed out, was 350 ft x 1200 ft and was heated entirely with panels. An indication of the interest of the membership in Mr. Colby's discussion was the fact that the question and answer period continued for more than an hour after the meeting had been officially closed at 9:30 p. m. Attendance 170. Attendance ratio .347.

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Indiana—November 19, 1948. After dinner at LaRue's Restaurant, Indianapolis, Pres. Paul R. Jordan called for a report from the secretary on the Board of Governors meeting held earlier in the evening. It was suggested that members having items to be included on the agenda at the 55th Annual Meeting at Chicago contact the Chapter Delegate, Irwin W. Cotton.

Ward Fenstermaker, chairman of the student placement committee, submitted a report on the chapter's aid in securing positions for engineering graduates. The chairman of the student Chapter guest committee, Richard James, greeted nine student members from Purdue and urged further participation in student attendance and sponsorship on the part of Chapter members

Charles Hagedon, chairman of the meetings committee, announced that, at the January 28 meeting, G. D. Winans of The Detroit Edison Co. would address the Chapter on *Steam Distribution*. Gerald Post gave some details of the coming Christmas Party.

The meeting was then turned over to Walter W. Grear, who introduced Carl Boester. Mr. Boester spoke on the *Heat Pump*, going into considerable detail on heat sources, and giving some interesting pictures from test installations he had made, including a unit using an internal combustion engine. After the formal presentation, the meeting was open to questions. A stimulating discussion followed regarding the residential housing situation and prospects for construction in 1949. The discussion included much information on prefabricated housing. Attendance 58.

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Iowa—December 14, 1948. At the Des Moines Club, with Pres. Daniel C. Murphy presiding, members heard an interesting talk on the *Heat Pump*, given by John F. Sandfort, associate professor of Iowa State College. Introduced by Vice Pres. Donald E. Wells, Professor Sandfort compared the heat pump with other heating methods and fuels. He used slides with graphs and formulas to explain the thermodynamics of the heat pump, and discussed applications now being found for this heating method, particularly in the Equitable Building in Portland, Ore. His informative talk was well received by the members and President Murphy extended hearty thanks to him.

Marvin E. Gould reported on the desirability of promoting a student branch at the Iowa State College, and the membership committee was instructed by the Chapter to proceed with student branch planning.

The Annual Meeting at Chicago was discussed, and a committee was appointed by President Murphy to study the subject of selecting Chapter officers and delegates to the Annual Meeting. This committee is as follows: Fred E. Triggs, chairman; Tracy R. Johnson, Perry LaRue, and B. E. Landes, committee members.

Progress of the State Building Code Committee was reported on by John F. Sandfort. The legislative committee was charged with formulating recommendations as to the Iowa Chapter's further participation in the work of the Building Code Committee, relative to bringing this matter before the next session of the Legislature. Attendance 30.

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Manitoba—November 18, 1948. After J. R. Stephenson, president of the Chapter, had summarized current correspondence from the Research and Research Promotion Committees of the Society, there was a discussion of various aspects relating to Society dues and publications.

Speaker of the evening was C. N. Helyar, who was introduced by Einar Anderson. Mr. Helyar described a heating system designed for lignite coal. This system, said Mr. Helyar, through a combination of mechanical firing and ash disposal with an efficiently operated service organization, results in work-free, dirt-free heat. A short movie depicting this system was shown. Attendance 20. Attendance ratio 0.53.

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Massachusetts—November 16. An excellent talk by L. E. Seeley, dean of engineering of the University of New Hampshire and ASHVE treasurer, was enthusiastically received by the Chapter. The title of Dean Seeley's talk was *What Kind of a Society Do We Want?*

Pins were presented to the following past presidents of the Massachusetts Chapter: Edmond A. Dusossoit, Frederick R. Ellis, Thomas F. McCoy, Ralph S. Franklin, William A. McPherson.

Current activities in the Society's Research Laboratory in Cleveland were reported on by Clyde A. McKeeman, assistant to the president, ASHVE. His report was well received by the audience, which asked a number of questions. The Emergency Planning and Research Bureau's executive director, E. L. Moulton, described the placement service which the Bureau has for architects and engineers. Attendance 35. Attendance ratio 0.31.

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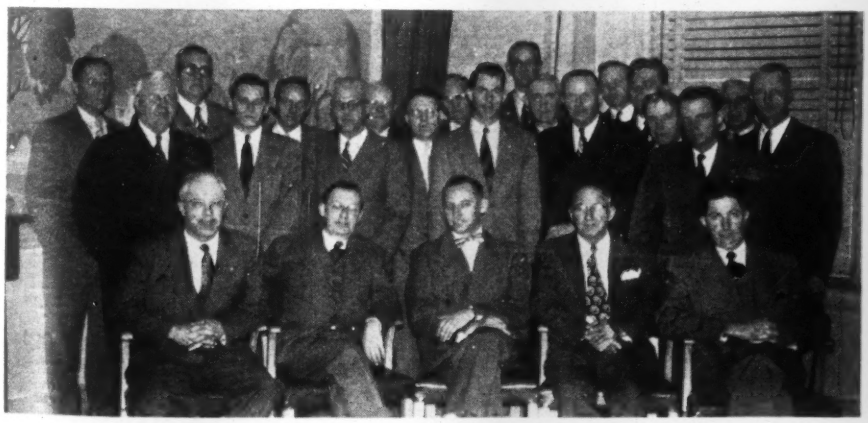
Michigan—November 15. The regular monthly meeting was a dinner held at the Horace A. Rackham Memorial Building. After committee reports were made, two new members, D. P. Cunningham and T. S. Carby, were introduced.

Sterling S. Sanford and Daniel H. Lewis reported on their activities in aiding in the revision of city ordinances, to license refrigeration op-



Iowa Chapter members and guests who attended the November 9th meeting at which Professor Nathaniel Glickman spoke. Professor Glickman is the center figure in the front row. On his right is Daniel C. Murphy, Iowa Chapter president

erating engineers and to revise the fuel oil heating equipment code. At W. O. Smith's suggestion, Mr. Lewis described the code as a division into two classifications: Class A, covering licensing for grades 1, 2 and 3 light oil and Class B, unlimited licensing for all grades of fuel oil.

Pres. Eric F. Hyde announced his appointment of George W. Akers as the Chapter's liaison research officer with the Society, and Mr. Akers described liaison duties. President Hyde also read the report of the Chapter's delegate discussing the last meeting of the delegates at Bretton Woods, June 21 and 22, 1948.

A motion by the board of governors, presented at the regular October 11 meeting, was read by the secretary and was seconded, and unanimously approved by the Chapter members. The secretary also read a letter from A. V. Hutchinson about the Michigan Chapter's offer to be host to ASHVE in June 1950.

W. S. Harris, special research associate professor at the University of Illinois, was presented to the group by Laurence A. Burch, chairman of the program committee.

Professor Harris then read a paper on *Baseboard Radiant Heating,* which was considered excellent by the audience. Prof. Harris described tests conducted at the University of Illinois in cooperation with the *Institute of Boiler and Radiator Manufacturers* and showed results of comparative tests on small tube radiators, type R and type RC. The particular benefits of baseboard heating, he said, were that quite uniform temperatures at all levels in the heated room were attained, with especially good temperatures at the floor level. Attendance 54.

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Nebraska — December 14, 1948. Smoke abatement was the central theme of the December meeting held in a dining room of the Regis Hotel. Guests included Herbert A. Ulrich, chief smoke regulation engineer, and his two assistants, Stanley Silverman and Howard Clements. Other guests included representatives of several cities, real estate agents, and other interested persons. Pres. Kenneth R. Magarrell welcomed guests and introduced Chapter officers to them.

Before introducing the guest speaker, Chester A. Carter, vice president, talked on the interest of the local Chapter in assisting the city smoke regulation engineer and his two assistants, with a view toward eliminating the smoke hazard.

The guest speaker was Prof. Raymond R. Tucker of Washington University, St. Louis, who spoke on the subject, *A Smoke Abatement Plan That Works.* Professor Tucker presented the plan for smoke abatement which was successful in St. Louis and several other large cities. He described many problems that had confronted them at the start of the campaign and discussed also some pitfalls that should be avoided. After the talk, Professor Tucker opened the meeting for discussion, and answered many questions from the audience. Attendance 44.

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North Texas—December 21, 1948. The December meeting was the annual party, including refreshments and dinner, at the Lakewood Country Club. A total of 230 members and guests attended. The following officers were elected: George A. Linskie, *President;* Herman Blum, Jr., *Vice President;* A. B. Ullrich Jr., *Secretary;* Robert E. Allison, *Treasurer;* E. T. Gessell, C. R. Gardner and J. P. Ashcraft, *Board of Governors.* Reg. F. Taylor of the South Texas Chapter and several other Houston, Austin and Waco men were introduced. The meeting was turned over to the Joan Frank Productions, and an excellent show was presented.

North Texas—November 15, 1948. The meeting was held at the Melrose Hotel with Pres. Benjamin S. Foss, Jr., presiding. M. K. Gardner discussed the Texas Chapter's special train to Chicago, for the 1949 Annual Meeting, and also gave a resumé of the San Antonio meeting which he attended.

Prof. G. L. Tuve, president of the Society, introduced by Mr. Gardner, gave an interesting talk on the future of air conditioning, with a very favorable viewpoint toward progress in air conditioning ma[illegible] in Texas. He pointed out the possibility of using solar, underground and atomic heat. He further emphasized the importance of health in air conditioning, and control. Professor Tuve described one of the research projects conducted for the past 12 years by ASHVE. This project, the determination of air flow through grilles, brought forth interesting comments by the members. Attendance 74.

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Northeastern Oklahoma—November 8, 1948. The fellowship period for members and guests of the Chapter began at 6:00 p. m. in the Red Lacquer Room of the Alvin Hotel. After dinner, Frank M. Thomas, chairman of the program committee, announced that the next meeting would be held on December 8, the speaker to be John James, chief research engineer of McDonnell & Miller, Inc., and his subject for that evening would be *The Research Story on Hot Water Safety Relief Valves.*

The results of the election of officers, ballots having been handled by mail since the last meeting, were counted and L. S. Reagan, chairman of the nominating committee announced that the officers elected were: W. R. Lee, *President;* A. D. Holmes, *Vice President;* J. N. Watt, *Treasurer;* and R. F. Shoemaker, *Secretary. Board of Governors:* Edwin Jones, W. C. Roads, and L. S. Reagan. The Board of Governors was then appointed as the constitution and by-laws committee.

Guest speaker, introduced by Frank Thomas, was Nathaniel Glickman, assistant professor of medicine and research physiologist, department of medicine, University of Illinois, who addressed the Chapter on *Physiological Adjustments to Sudden Changes in Environment,* with particular emphasis on air

conditioning shock. At the conclusion of the talk there was an enthusiastic question and answer period. Attendance 26.

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Northern Ohio—December 13, 1948. A talk on electric precipitators and the election of a Chapter delegate were among the events of the December meeting in the Cleveland Engineering Society Building.

Pres. W. R. Moore called on R. E. Sherman and Ralph E. Leising to give the treasurer's and membership reports. William Branch and Raymond Geiger were accepted for Chapter membership.

Announcement of Prof. Nathaniel Glickman as speaker for the January meeting was made by Dennis Boggs, program chairman. Walter Rhoton reported on the plans for the C.T.S.C. Banquet to be held on January 31 at the Carter Hotel.

Following these reports, Lester T. Avery described aspects of ASHVE, including his visits to Chapters, Society dues, public relations and the publications.

R. L. Byers was elected Chapter delegate and D. E. Mannen alternate.

The talk on *Electrostatic Precipitators* was given by James W. May of Louisville, Ky. He was introduced by Mr. Boggs, and made a talk that was both instructive and entertaining. Speaking of the development and application of electrostatic filters in air work, Mr. May combined a thorough technical knowledge with a refreshing descriptive ability. Attendance 106.

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Oklahoma City—December 13, 1948. At the meeting held at Beverly's Drive-In, President John H. Spaan, Jr. presided. The Program Committee reported that the January meeting would be devoted to air filtration.

Robert N. McGee of Jones-Laughlin Steel Corp., was the speaker and assisted by W. C. Jamieson. he illustrated his vivid talk with movies.

The time and material required to produce steel pipe were interesting points brought out in the discussion. All types of pipe were discussed, and electric-welded tubing in connection with automobile production was also stressed. Attendance 32.

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Ontario—December 6, 1948. At the dinner meeting in the Royal York Hotel, Pres. Edward G. Spall announced that Norton W. Kingland would be chairman of the On-To-Chicago Committee. After the short business meeting, Col. M. P. Jolley, O.B.E. of the *Canadian Industrial Preparedness Association*, spoke on *National Industrial Preparedness*. His instructive talk was followed by a lively discussion and David H. Butler, speaking for the Chapter, extended a vote of thanks to the Colonel. Attendance 70. Attendance ratio 0.29.

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Pacific Northwest—December 7, 1948. The December meeting of the Chapter was called to order at the Engineers Club in Seattle, Wash. The meeting was presided over by President Leslie L. Bysom who announced the appointment of the following members to act as the nominating committee: Edwin H. Langdon, Robert D. Morse, Richard M. Stern, Clarence A. Pangborn, and Sterling D. Peterson. Inasmuch as the Secretary had been unable to attend the November meeting held in Portland, Edwin H. Langdon, who had been in attendance, read the minutes of the last meeting.

James D. Sparks introduced James B. Notkin who was responsible for the program of the evening. Mr. Notkin in turn introduced the speaker, George Kipper, of Kipper & Wyatt, who gave an engineering contractor's viewpoint on *Boiler-House Installations*. Mr. Kipper's interesting presentation aroused many questions and considerable debate. Attendance 59.

Philadelphia—December 9, 1948. President J. Owen Kirkbride called the meeting to order at the Engineers' Club. After the reading and approval of the minutes of the November meeting and of the treasurer's report, H. W. Alyea of the Johnson Service Co., Milwaukee, spoke on the subject, *Fundamentals of Pneumatic Controls*. The meeting adjourned at 9:50 p. m. Attendance 75.

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Pittsburgh—December 13, 1948. Following dinner at Hotel Webster Hall, the meeting was called to order by Pres. H. E. Park. The chairman of the program committee reported that L. N. Hunter, chairman of the ASHVE Committee on Research, would speak at the January gathering. President Park introduced the speaker of the evening, R. S. Simpson of the Bell Telephone Co. Mr. Simpson spoke on the responsibilities, maintenance, and other activities of the telephone company, with the promise to show the Chapter some sound movies at a later date. Attendance 29.

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Rocky Mountain—November 3, 1948. Members indulged in a Town Hall type of gathering, with Pres. Fred Janssen turning the meeting over to Edward J. McEahern, program chairman. The chairman then introduced Harold W. Marshall as moderator, with Dan McQuaid and Lynn Wray on the discussion panel.

Problems brought up and discussed in this open forum included: the use of unapproved liquefied petroleum gas boilers and requirements for their control; operating and maintenance instructions for equipment manufacturers and the carrying out of instructions by contractors and distributors; failure of automatic controls and the resulting hazards; and apparatus ratings at high altitudes. This last subject resulted in a suggestion to continue its discussion at a future meeting. Interest in the meeting was ex-

pressed by the members' desire for another open forum type meeting soon.

A report by Nelson Brickham on activities relating to the sheet metal and gas codes preceded the open forum. Attendance 21. Attendance ratio 0.31.

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St. Louis—December 7, 1948. A colored 16 mm film about St. Louis was presented by Dean William Glasgow Bowling, Washington University, at the December meeting in the York Hotel. Dean Bowling added comments on the film, and both his talk and the film were received with great interest by the members.

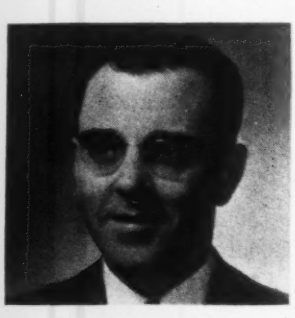
Pres. Bruce L. Evans called upon Henry C. Sharp, Edward T. Clucas and F. Edward Ince to make committee reports. Mr. Ince invited the Chapter to attend the *ASRE* meeting, December 13, at Bill Medart's, where A. R. Clark would speak. Attendance 31.

South Texas—November 11, 1948. Many visitors were introduced at the meeting held at the Rice Hotel, Houston. Prof. C. W. Crawford presented 41 members of the Student Branch from Texas A. & M. College, and Prof. L. S. O'Bannon of the A. & M. faculty was introduced. Prof. Wayne E. Long presented 4 students from the University of Texas. Also introduced were C. R. Gardner and a group from North Texas Chapter.

William J. Way and Fred C. Brandt reported on the meeting of the Engineers Council, which is sponsoring a symposium on Conservation of Natural Resources, to be held in April 1949. Donald M. Robinson announced that the next meeting would be the annual Christmas Party to be held on December 17, 1948. S. E. Ammons, president of the Texas A. & M. Student Branch, reported on a joint meeting to be held at the College on December 7. This meeting will include all of the Texas Chapters, the Shreveport Chapter and the Tulsa Chapter.

Shreveport Chapter Officers

W. E. FitzGerald
Charter President



A. H. Otto
President-Elect

B. Segall, Jr.
Vice President

Robin M. Hood
Treasurer

S. W. Beaty
Secretary

The president announced the election of R. J. Salinger as delegate to the Annual Meeting in Chicago, with L. L. Ladewig as alternate.

The speaker of the evening was introduced by Reg. F. Taylor, and was Prof. G. L. Tuve, president of ASHVE. Professor Tuve made several predictions for the field of air conditioning. Among these were: the heat pump will be a competitor of oil and gas; central station air conditioning will be prominent in the future; atomic power will not be too far away; solar heat is possible; future air conditioning will be for health, not for comfort. Professor Tuve also spoke of the ASHVE and a question and answer period followed. Subjects discussed included research projects, topics for Society meetings, and research papers from Chapters. Attendance 168. Attendance ratio 0.42.

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Southern California—December 15, 1948. There were two speakers at the December meeting held at Eaton's Restaurant in Beverly Hills. Andrew H. Rose, Jr. spoke on *Progress Toward Solution and Elimination of Air Pollution in Los Angeles County*, using a sound film on smog to accompany his lecture. Harry Kunkle of the Los Angeles Air Pollution Office, discussed the amount of business which has been derived from the smog program in the Los Angeles area.

President Richard S. Farr presided. Attendance 70.

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Utah—December 13, 1948. Vice President C. E. Ferguson opened the meeting in Covey's Coffee Shop and he made a report on Society membership, while D. B. Holford, chairman of the legislative committee, reported on correspondence with Mayor Earl J. Glade relative to a uniform heating code for Salt Lake City.

The guest speaker, Howard Barker, superintendent of buildings and grounds, Salt Lake City School Board, spoke on *Heating and Ven-*

tilating School Buildings. The discussion was led by H. G. Richardson, member of the program committee and centered around the relative merits of unit ventilators versus the split system for school rooms.

Vice President Ferguson presented a diamond studded past president's pin to Earl V. Gritton. Attendance 28.

Utah—November 15, 1948. President Edward J. Watts called the meeting to order at Covey's Coffee Shop, and addressed the meeting on the progress of the Society and on research. Results of the vote on a change of meeting night were read, and it was decided that the Utah Chapter meeting night would be the second Monday of each month.

The meeting was turned over to Jed L. Ashton who introduced the guest speaker, Mayor Earl J. Glade of Salt Lake City. Mayor Glade addressed the meeting on the subject of *Proposed New Projects for Salt Lake City*. He was very complimentary to the Society and to the Utah Chapter, and invited the Chapter to write a letter offering the services of the Chapter regarding the formulation of a uniform heating code for Salt Lake City. He expressed a keen desire to have the power and heating division of the City Government work with the Utah Chapter in the development and planning of the division's activities. Attendance 11. Attendance ratio 0.27.

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Virginia—November 17, 1948. The auditorium of the R. F. Trant Co. building was the scene of the November meeting, which was called to order by Jesse E. White, acting president. Mr. White read excerpts from the booklet *The Aims and Activities of the ASHVE* for the benefit of the many visitors. The following members were elected to the nominating committee: John F. Boyenton, chairman; Elair D. Duval, John F. Reynolds, John M. Stokley, and Ralph C. Thomas.

John F. Boyenton, program chairman, introduced the speaker, Frank G. Foltz, of the Yarnall-Waring Co., who showed a movie prepared by his company and entitled *There Is an Engineering Reason*. A discussion followed. Attendance 48.

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Washington, D. C.—December 8, 1948. Refreshments and dinner were features of the December meeting at the Old New Orleans Restaurant.

Pres. A. S. Gates, Jr. asked for suggestions for a speaker at the Ladies Night meeting to be held in March. He also requested suggestions for inclusion in the agenda of the Chapter Delegates Annual Meeting. Finally he read a letter from Society headquarters regretting that an invitation to hold the 1949 Semi-Annual Meeting in Washington could not be accepted. A motion was made from the floor to issue an invitation for the 1950 Semi-Annual Meeting.

Sec'y. John G. Muirheid reported attendance at a meeting of heating contractors, dealers, jobbers, and inspectors, in the interest of raising the standard of gas-fired heating system installations in the Washington area. Particular attention was called to the leadership of this movement. Members of the committee which originated the action were Albert P. Mergardt, *Chairman*, Isaac M. Bortman, Ben P. Robeson, of this Chapter, and others. They were joined in their work by L. Ourusoff and L. Bert Nye, Jr., each a past president of the Chapter.

John J. Everetts, Jr. introduced the speaker of the evening, Matthew M. Lawler, general manager of the air conditioning and refrigeration division, Worthington Pump and Machinery Corp. Mr. Lawler's talk, entitled *Comment on the Design of Centrifugal Compressors*, described the centrifugal compressor and compared it with the reciprocating compressor. He discussed the parts of the centrifugal compressor, the most advantageous applications, the operating characteristics, and various refrigerants used. This machine was defined as a heat pump with gas as the carrying vehicle. The requisites of the centrifugal compressor were given as: (1) mechanical ruggedness, (2) efficiency, (3) stability over wide ranges of capacity, and (4) quiet operation. Methods of capacity throttling were discussed, as well as steam turbine and synchronous motor drives.

After answering many questions, Mr. Lawler was thanked by the president. Attendance 50.

Washington D. C.—November 10, 1948. Dinner was served at the Old New Orleans Restaurant, after which the meeting was called to order at 8:00 p. m. by Pres. A. S. Gates, Jr. Visitors and new Chapter members were introduced and all were welcomed by the president.

Following a report by Richard S. Dill, the Chapter's representative at the Semi-Annual Meeting of the Society, a member of the Washington-Baltimore section of *ASRE* invited the Chapter to attend the Annual Meeting of that organization to be held December 5 to 7 at Washington.

The resignation of Foster J. Pratt, treasurer of the Chapter, was accepted with regret. Mr. Pratt, who is going to Paris for the Economic Recovery Administration, was thanked for his loyal support of Chapter activities over many years and was accorded the best wishes of the Chapter in his future work. Philip H. McKim was elected treasurer to succeed Mr. Pratt.

F. M. Thuney, chairman of the meetings committee, then introduced the speaker, John W. Norris, vice president of Lennox Furnace Co. Mr. Norris spoke on *Air Distribution Problems in Domestic Forced Warm Air Heating Systems*. He expressed his preference for constant blower operation whenever there is a continuing heat loss from the space being heated. His objections to intermittent blower operation were frequent overheating of rooms and the difficulty of evenly heating the room farthest from the furnace. The new highly sensitive thermostats were given as the answer to many system ills, along with proper refractory design. Interest

in Mr. Norris' talk was evidenced by the prolonged question-and-answer period which followed. Members adjourned at 11:00 p. m. after a vote of thanks to Mr. Norris. Attendance 60.

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Western Michigan—December 13, 1948. Seventy-seven members and guests attended the dinner meeting presided over by Pres. Harold W. Wolters at Hunt's Food Shop in East Lansing.

K. E. Robinson was appointed the chapter representative on the Committee on Promotion of Research. Mr. Robinson then discussed the activities of the membership committee.

A joint meeting with the *National Warm Air Heating and Air Conditioning Association* short course members was planned for March 22, 1949 with Cyril Tasker to be the speaker.

John L. Alexander then introduced Thomas A. Walters, research director of the American Blower Corp., Detroit, Mich., who spoke on *Fan Selection and Sound Control.*

Dean L. G. Miller gave a brief talk on the cooperative research being carried on at Michigan State College with the help of the Society. The project is called *Resistance of Take-Off from Rectangular Duct Lines.* Attendance 77.

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Wisconsin—December 13, 1948. The December meeting was held at the Engineers' Society Building, with 32 members and guests present. After dinner, Pres. W. A. Ouweneel called the meeting to order. John A. Lofte, chairman of the membership committee announced that W. R. Wendt, Jr. had been accepted as a member of the Wisconsin Chapter. Robert D. Rodwell, chairman of the program committee, stated that the speaker for the ladies' night meeting to be held on January 17 would be Captain Granfield of Great Lakes Naval Training Station and the Navy League. He would speak on Navy Training of Personnel.

The death of member Max H. Kliefoth was announced, and Chapter members voted to send an expression of sympathy to the family.

The speaker, Bruce Jacobi, chief mechanical engineer of Lerner Stores, Inc., New York City, was introduced by Robert Rodwell. Mr. Jacobi's talk concerned *Chain Store Air Conditioning.* He stated that air conditioning saved his company thousands of dollars annually by preventing staining and smudging of merchandise due to handling by customers. The manner of determining overall cooling load was explained and semi-cooled lobbies, hot air door curtains, fitting room and grille location problems were discussed. Maintenance, an important phase of air conditioning, is handled by field service men, Mr. Jacobi said. Lighting controls and filters were also discussed. Mr. Jacobi stated that an additional measure of the value of chain store air conditioning systems lay in the fact that sales decrease when the system in a store fails to function. The question and answer period followed. Attendance 60.

Student Branches

North Carolina State College—November 23, 1948. The Student Branch met in Page Hall, North Carolina State College. Pres. John G. Marshall called the meeting to order and appointed S. T. Wiggins temporary chairman of the placement committee, and C. W. Smith chairman of the ASHVE committee for the Engineer's Fair.

Robert A. Baker was authorized to inspect the Society's Laboratory in Cleveland and report back to the Student Branch.

The meeting was then turned over to Prof. L. L. Vaughn, Faculty Advisor. Professor Vaughn summarized the proposed curriculum leading to the degree of B.S. in Heating and Air Conditioning which the mechanical engineering department is soon to inaugurate. In addition to the various technical courses, this new curriculum will include much new material on financial organization, management, and manufacturers' equipment. Attendance 27.

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Texas A. & M. College—December 3, 1948. The meeting was called to order in the ME Building Lecture Room by Pres. Staron E. Ammons. In accordance with the custom of the Branch, everyone present stood and introduced himself to the group. Final arrangements were made for the joint meeting to be held December 7 at the Fin Feather Club at Bryan, Tex. Several committees were appointed to handle various duties.

A discussion of the Society's Annual Meeting to be held in Chicago in January then followed, with Prof. L. S. O'Bannon outlining the program and various activities scheduled there.

The selection of delegates to represent the Student Branch of Texas A. & M. was held, with the following results: C. P. Howard, 1st Delegate; R. S. Segall, 2nd Delegate; H. J. Bettencourt, Jr., 1st Alternate; J. G. Blum, 2nd Alternate. Attendance 25.

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Texas A. & M. College—November 11, 1948. The student branch held its November meeting in conjunction with the South Texas Chapter in Houston on November 11 to enable the students to hear Prof. G. I. Tuve, president of ASHVE. There were forty student members present from Texas A. & M., Prof. L. S. O'Bannon, sponsor of the student branch, and Prof. C. W. Crawford, head of the mechanical engineering department of A. & M. College.

Prof. Tuve's talk held a special interest for the students as he gave five predictions for 1960 on the advance of air conditioning. The predictions concerned the supply of energy, automatic controls, designs for health, dispersion of air conditioning units, and professional and scientific engineering. Attendance 40.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When the replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 151 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by February 25, 1949, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

ACHESON, C. R., Owner, Cedric R. Acheson, Cons. Engr. PROPOSERS: H. K. Ormsby, C. F. Woese. SECONDERS: J. H. Carpenter, B. C. Goodhue.

ANDERSON, R. G., Partner, F. W. Jenike Co. PROPOSERS: H. A. Pillen, J. J. Bechtol. SECONDERS: E. W. McNamee, O. W. Motz.

APPELTON, HARRY, Mech. Engr., Universal Refrigeration, Ltd. PROPOSERS: A. M. Dion, D. A. Long. SECONDERS: A. M. Clark, E. A. Allcut*.

BELYEA, H. A., Industrial Hygiene Engr., Ontario Dept. of Health. PROPOSERS: H. R. Roth, J. W. Powelsland. SECONDERS: F. G. Ewens, J. J. Lawlor.

BERKMAN, ALBERT, Estimator-Engr., The James J. McHale Co. PROPOSERS: S. F. Frensdorf, J. L. Berger. SECONDERS: W. M. Rogers, R. W. Dickson, Jr.

BOLAFFIO, R. E., Sarco Co., Inc. PROPOSERS: E. J. Ritchie, R. W. Cumming. SECONDERS: T. N. Adlam, Louis Barfus.

BROWN, MORRIS, Engr., Stone & Webster Engineering Corp. (*Advancement*). PROPOSERS: D. W. Blair, D. M. Collins. SECONDERS: N. J. Shaw, W. H. Shipp.

DANFORTH, T. F., Engr., Backus, Crane & Love, Archts. PROPOSERS: W. E. Voisinet, William Roebuck, Jr. SECONDERS: M. S. Jackson, C. H. Love.

DYKTOR, H. G., Commissioner, Div. Air Pollution Control, City of Cleveland, Dept. Public Health & Welfare. PROPOSERS: W. N. Witheridge, Lester T. Avery. SECONDERS: J. E. Wilhelm, W. M. Rowe.

DYSON, R. H., Vice Pres., Canadian Ice Machine Co., Ltd. PROPOSERS: H. R. Roth, M. W. Shears. SECONDERS: R. A. Stencel, R. S. Mathison.

FALLER, H. J., Mgr. Htg. Dept., Straus-Frank Co. PROPOSERS: B. P. Fisher, D. M. Robinson. SECONDERS: D. M. Mills, C. C. Quin.

FALVEY, W. J., Sales Engr., Wolverine Equipment Co. PROPOSERS: G. B. Gerrish, W. A. Williams. SECONDERS: W. H. Shipp, C. H. Don.

FISHER, B. P., Owner, Southern Furnace & Supply Co. (*Advancement*). PROPOSERS: R. F. Taylor, D. M. Mills. SECONDERS: A. F. Barnes, W. E. Long.

FLICKINGER, R. T., Sales Engr., McDonnell & Miller, Inc. PROPOSERS: E. N. McDonnell, N. W. Swanson. SECONDERS: J. A. Solon, George La Roi.

FORVE, C. J., Sales Engr., R. D. Bitzer Co. PROPOSERS: G. F. Smith, H. J. Walther. SECONDERS: C. F. Wiltberger, M. E. Barnard.

FOSSELMAN, J. C., Htg. Engr., Globe Machinery & Supply Co. PROPOSERS: C. W. Helstrom, D. E. Wells. SECONDERS: W. B. Schuler, D. C. Murphy.

FROST, M. F., Designer, Reg. F. Taylor, Cons. Engr. PROPOSERS: H. L. DeVines, R. J. Salinger. SECONDERS: R. F. Taylor, R. R. Kriechbaum.

GRIGSBY, J. C., Student, A. & M. College of Texas. PROPOSERS: L. S. O'Bannon, W. P. Taylor*. SECONDERS: C. M. Simmang, L. G. Berryman*.

GRIZZARD, J. P., Mgr., Johnson Service Co. PROPOSERS: H. W. Broadwell, R. J. Salinger. SECONDERS: I. A. Naman, W. J. Way.

GUNTHER, ORVILLE, Self employed. PROPOSERS: A. R. Curtis, J. L. Ashton. SECONDERS: C. E. Ferguson, E. J. Watts.

HARLAN, O. P., JR., Sales Engr., Clowe & Cowan, Inc. PROPOSERS: L. S. Gilbert, A. B. Ullrich, Jr. SECONDERS: P. N. Vinther, C. O. Towne.

HEATON, W. L., Draftsman, Johnson Service Co. PROPOSERS: Harold Stamps, J. J. Philippi. SECONDERS: C. K. Henriksen, G. W. Bornquist.

HEDDESHEIMER, CARL, Sales Engr., Darling Brothers Ltd. PROPOSERS: E. H. Price, D. F. Michie. SECONDERS: R. L. Kent, D. S. Swain.

HERDMAN, C. T., Staff Engr., Johns-Manville Sales Corp. PROPOSERS: J. S. Parkinson, V. L. Whitacre. SECONDERS: E. R. Williams*, H. E. Bowman.

HICKNER, G. B., Student, University of Minnesota. PROPOSERS: A. B. Algren, R. C. Jordan. SECONDERS: F. B. Rowley, O. L. Lilja.

INCE, R. B., Engr., West Texas Distributing Corp. PROPOSERS: E. A. Rapp, Buster Welch. SECONDERS: W. R. Anthony, G. H. Wessler, Jr.

JAMAL, V. J., Student, University of Michigan. PROPOSERS: A. B. Epple, Axel Marin. SECONDERS: F. N. Calboun, R. C. Porter*.

JEMISON, E. B., Student, A. & M. College of Texas. PROPOSERS: L. S. O'Bannon, W. P. Tayler*. SECONDERS: C. M. Simmang*, L. G. Berryman*.

KOESTEL, ALFRED, Instructor, Case Institute of Technology. PROPOSERS: G. L. Tuve, L. G. Seigel. SECONDERS: W. L. Bryan, L. C. Hays*.

KOSSON, R. L., Instructor, Dept. of Mechanical Engineering, University of Minnesota. PROPOSERS: A. B. Algren, R. C. Jordan. SECONDERS: F. B. Rowley, O. L. Lilja.

KRUEGER, HENRY R., Part Time Draftsman & Student, Governair Corp. PROPOSERS: E. F. Dawson, M. D. Creel*. SECONDERS: J. H. Thomas*, E. M. Sims*.

LENDERS, A., Ph., Engineering Counsel. PROPOSERS: Maurice Herman, Paul Lebrun. SECONDERS: Fernand Ghillardi, André Desplanches.

LOVENBERG, A. M., Application Engr., Edlee Distributors, Inc. (*Advancement*). PROPOSERS: L. B. Mann, M. E. Mooney. SECONDERS: L. C. Hanson, S. F. Shawhan.

LUCAS, C. S., Sales Engr., Associated Sales Engrs. PROPOSERS: W. M. Wallace II, R. S. Dill. SECONDERS: P. B. Holmes, J. R. Nurney*.

LUEDTKE, CHARLES, JR., Student, A. & M. College of Texas. PROPOSERS: L. S. O'Bannon, W. P. Taylor*. SECONDERS: C. M. Simmang*, L. G. Berryman*.

MARTIN, O. E., Student, A. & M. College of Texas. PROPOSERS: L. S. O'Bannon, W. P. Taylor*. SECONDERS: A. V. Brewer*, C. M. Simmang*.

MATTIOLI, C. N., Air Cond. Engr., Voorhees, Walker, Foley & Smith. PROPOSERS: J. K. Fairbairn, Herbert Hecht. SECONDERS: J. W. Barrett*, Albert Giannini.

MCCORD, W. C., Student, A. & M. College of Texas. PROPOSERS: L. S. O'Bannon,

*Non-member

W. P. Taylor*. SECONDERS: C. M. Simmang*, L. G. Berryman*.

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PERSONALS

Prof. Seichi Konzo of the University of Illinois College of Engineering, is leaving active direction of the warm air heating research work there after 19 years with it. He was honored at the recent December meeting of the *National Warm Air Heating and Air Conditioning Association* in Cleveland, Ohio. Professor Konzo is now giving his attention primarily to graduate teaching, while continuing as advisor on heating research.

Robert W. Roose is heading the four-man team carrying on warm air studies, a part of 12 men giving full-time to heating research at Illinois, while Professor Konzo is among five members of the University heating engineering staff whose attention is primarily on teaching, but who also help with research.

At the Cleveland meeting, Professor Konzo was presented with an illuminated scroll and two handsome pieces of luggage in appreciation of his work. Both Professor Konzo and Mr. Roose are members of ASHVE and are authors of technical papers.

Richard P. Hankins and Nicholas M. Trapnell have announced the establishment of their firm, Hankins and Trapnell, consulting engineers, at Richmond, Va. Their firm will deal with: surveys, reports, economic studies and design of mechanical equipment for buildings, power plants, industrial plants, railway motive power and maintenance facilities. Mr. Hankins is a member of the Society.

Roy O. Nelson, for the past three years assistant sales manager of Marsh Heating Equipment Co., Skokie, Ill., is now with the C. H. Bevington Co., Chicago, with which he was associated a few years ago. A member of ASHVE, Mr. Nelson is in charge of sales.

Earl G. Morgan has become sales engineer for the Superior Refrigeration Supply Co., Kansas City, Mo. In addition to being a member of ASHVE, Mr. Morgan belongs to the *ASRE* and is a past chairman of that organization's Kansas City section.

H. Leigh Whitelaw, managing director of the *Gas Appliance Manufacturers Association*, New York, and a member of ASHVE, has announced a new promotional program for the automatic gas water heater industry. This program will be in charge of Stanley C. Gorman of Los Angeles.

PURDUE STUDENT BRANCH PLACEMENT COMMITTEE ACTIVE

The Purdue Student Branch of the ASHVE is setting up a Placement Committee for its members. The Committee invites any firms engaged in heating, ventilating or air conditioning in the United States to communicate with it regarding employment opportunities in this field. The men of this branch would be glad to contact these interested firms. This would eliminate the necessity of prospective employers sending their talent scouts to the campus.

Communications on this subject should be addressed to the Purdue Student Branch ASHVE, Placement Committee, Purdue University, W. Lafayette, Ind.

COMFORT ENGINEERING EXTENDED TO FARMS

Farmers are becoming increasingly comfort-minded, according to a recent survey conducted by the U. S. Department of Commerce.

On American farms at the present time, there are a half million more central heating systems than were in use in 1940. This increase represents improvement in dwelling standards and is typical of the trend toward better buildings and better machinery and farming practices. New buildings and repairs on farms accounted for nearly seven billion dollars since 1940.

Throughout the past year, about 125,000 farm homes were built, and the increase in central heating systems indicates that not only new homes but homes already built have expanded their demand for air conditioning and central heating.

Despite the fact that farm population declined by about 10 percent, the farm building boom continues. In eight years, the number of farms with electric service has been doubled. Increasing electrification has been accompanied by improvements of all types, including the installation of equipment for comfort and convenience.

On the majority of farms these improvements include repairs to homes or adjacent buildings by the owners, who inhabit 65 percent of the nation's farms. Since 1940 the number of farms with steam, hot water, duct and pipeless warm air heating systems has increased from 700,000 to 1,200,000. In the north central states, central heating seems most prevalent, although the northeast portion of the United States follows close behind.

Improvements for the coming year are, of course, dependent upon maintenance of a high income level, but in the light of the change in the past eight years, air conditioning and heating systems should continue to come into wider use.

OBITUARIES

Philip F. Becker

Philip F. Becker, electrical engineer for the New York City Board of Transportation, died on November 24, 1948, at the age of 62.

Born in Russia in 1886, Mr. Becker received his education in New York City, starting at the College of the City of New York, where he received his B.S. degree in Mechanical Engineering in 1907. He then attended Columbia University School of Mines, graduating with an E.M. in Mining in 1912. Later, he attended the Pace Institute of Accounting.

Since 1928 he had been power plant designer for heating projects for the Board of Transportation, New York City. Previously he was associated with Electric Bond and Share Co., Brooklyn Edison Co., Thomas E. Murray, and Walter

Kidde Co., always in the capacity of power plant designer. He was a member of the New York Chapter of ASHVE and is survived by his widow.

Joseph J. Byrne

The death of Joseph J. Byrne, heating engineer with the Kleenair Furnace Co., Portland, Ore., has just been reported. He had been a member of the Society since 1939 and was born in Portland in 1887. Mr. Byrne was educated at the Portland High School, graduating in 1904, and at Portland's Columbia University, which he attended from 1905-1906. His early training in steam fitting led to employment by the Pacific Marine Co. Later he joined the Mueller Furnace Sales Co., for which he did considerable work on the designing of warm air plants for basementless houses.

At the time of his death, he was associated with the Kleenair Furnace Co., Portland. Mr. Byrne was instrumental in establishing a heating code for the City of Portland and also in having a department of heating set up as a permanent part of the building bureau. For many years he served as Chairman of the Appeal and Advisory Board for his city.

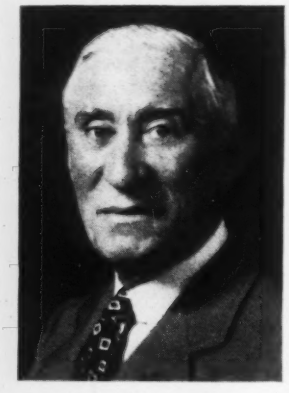
William J. Olvany

William J. Olvany, Life Member of ASHVE, died on December 13 at his home, 52 Tennis Place, Forest Hills, Queens, N. Y. at the age of 74.

A respected and distinguished member of the Society since 1912, Mr. Olvany had taken an active part in its affairs. Not only in the Society but in the heating and ventilating field in general, Mr. Olvany had many friends and associates in all parts of the country.

He was president and director of William J. Olvany, Inc., 100 Charles St., which he founded more than fifty years ago. Many public buildings and schools of New York contain heating and ventilating equipment whose installation was directed by Mr. Olvany.

A former president of the Boulevard Bank in Forest Hills, Mr. Olvany was also a past national



W. J. Olvany
Life Member

president of the *Heating, Piping and Air Conditioning Contractors National Association*. Other affiliations of Mr. Olvany were: member of Queensboro Lodge of Elks; member of the National Democratic Club; life member of the Tammany Society; formerly president of the Building Trades Employers Association of New York; member of the Knights of Columbus, Forest Hills Council, and the Holy Name Society.

Mr. Olvany's career in heating and ventilating began with his apprenticeship in steam fitting, followed by drafting, shop experience, engineering, contracting, and heating and power plant installation. From 1888 until the time of his death, he was connected with the heating and ventilating field as engineer and contractor.

He is survived by his wife, Mrs. Charlotte Link Olvany; two daughters, Miss Marie Helen Olvany and Mrs. Gertrude O. Faulkner; and two sons, William J., Jr. and George L. Olvany.

Max H. Kliefoth

Max H. Kliefoth, vice president of Research Products Corp., Madison, Wis., and member of the Society since 1939, died at the age of 52.

Born in Wismar-Meckl, Germany, 1896, he received his degree in chemical engineering from the Technische Hochschule Charlotten Burg, Berlin, University of Berlin in 1922. A year later, he emigrated to the United States and was employed by the Wisconsin Foundry and Machine Co. of Madison, Wis. Not long after, he became associated with the C. F. Burgess Laboratories, Inc., Burgess Titanium Co., and the related Research Products Corp., with whom he was associated at the time of his death.

Mr. Kliefoth was known for his designing of various equipment including plant layout for titanium processes, layout for the manufacture of air filters, and test equipment for the study of air flow and acoustics.

William W. Short

The death of William W. Short, president of William W. Short Co., Inc., New York City, occurred on December 20, 1948. He had been a member of the Society since 1942 and was well known in the ventilating and air conditioning field.

Mr. Short was born on Oct. 13, 1902 in Madrid, New York, and attended Dartmouth College and Syracuse University, from which he was graduated with a B.S. degree in 1925. He then entered the refrigeration and gas heating industries, and was associated with J. M. and C. B. Cooper Co., Syracuse, Westinghouse Electric Supply Co., and Blagden Bros., both of New York City. In 1941, he became field engineer for the Anemostat Corp. of America, and later organized his own company. He was a member of Sigma Alpha Epsilon.

Laurence J. J. Tierney

The Society has learned of the death of Laurence J. J. Tierney, West Roxbury, Mass., active in the heating field since 1919 and a member of the Society for many years.

Born on Sept. 1, 1889 in Dorchester, Mass., he studied in the Dorchester and South Boston High Schools, and later at the Franklin Union. Following association with W. D. Cashin Co., Boston, Mr. Tierney became a partner in the Tierney, Wilson Co. of New England.

At the time of his death, Mr. Tierney was the owner of the L. J. Tierney Co., Boston, which served as sales representative for the Chicago Pump Co., Pacific Steel Boiler Division of United States Radiator Corp., Jas. P. Marsh Corp., and Johnston Bros.

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Industrial Ventilation: W. N. Witheridge, *Chairman*; A. D. Brandt, W. B. Harris, W. C. L. Hemeon, D. E. Humphrey, C. W. Johnson*, J. M. Kane, M. G. Kershaw, L. L. Lewis, L. G. Miller*, H. A. Mosher, B. F. Postman, B. R. Small, W. M. Wallace, II, R. P. Warren, H. E. Ziel.

Insulation: E. R. Queer*, *Chairman*; R. E. Backstrom, C. B. Bradley, R. B. Crepps, C. H. Jefferson, H. E. Lewis, L. E. Pasek, H. E. Robinson, Vic Sanders, T. D. Stafford, L. V. Teesdale, R. K. Thulman, T. T. Tucker, P. M. Woodworth.

Navy Studies: G. L. Tuve, *Chairman*; E. F. DuBois, M.D., J. D. Hardy, M.D., E. R. Queer*, L. E. Seeley, C. P. Yaglou.

Panel Heating and Cooling: G. D. Winans, *Chairman*; A. B. Algren*, R. L. Byers, P. B. Gordon, L. N. Hunter* (*Ex-Officio*), John James*, J. S. Locke, John Magos, H. F. Randolph, Cyril Tasker (*Ex-Officio*).

Group A—Heat Distribution Within and Behind the Panel: P. B. Gordon, *Chairman*; A. B. Algren*, R. A. Biggs, R. S. Dill, H. L. Flodin, F. E. Giesecke, W. S. Harris, C. F. Kayan, G. D. Lain, R. L. Maher, C. W. Meininger, D. L. Mills, C. W. Nessell, P. S. Park, S. I. Rottmayer, E. E. Scott, S. K. Smith, R. K. Thulman, S. M. Van Kirk, W. J. Widmer, G. L. Wiggs, L. H. Yeager.

Group B—Heat Transfer Between the Panel and the Space: John James*, *Chairman*; H. F. Randolph, *Vice Chairman*; C. M. Ashley, J. T. Bergen, C. F. Boester, Wharton Clay, Linn Helander, A. L. Jaros, Jr., H. A. Lockhart, C. O. Mackey*, R. A. Miller, G. W. Penney, G. G. Sward, J. M. van Nieukerken.

Group D—Controls: J. S. Locke, *Chairman*; A. B. Algren*, H. W. Alyea, S. D. Browne, R. L. Campbell, C. M. Garner, P. B. Gordon, W. J. Hajek, A. J. Keating, W. H. Kliever, H. T. Kucera, P. F. Neess, R. S. Penn, J. K. M. Pryke, E. J. Ritchie, C. W. Signor, N. D. Skinner, A. S. Widdowfield.

Physiological Research: C.-E. A. Winslow, *Chairman*; Thomas Bedford, M.D., Capt. A. R. Behnke, MC, USN, E. W. Brown, M.D., A. C. Burton, M.D., E. F. DuBois, M.D., A. P. Gagge, R. W. Keeton, M.D., D. H. K. Lee, M.D., L. G. Miller*, André Missenard, Charles Sheard.

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North Carolina: Organized 1939. Headquarters, Durham, N. C. Meets, Quarterly. President, DeParx Stimson, 121 Idlewilde Dr., Winston-Salem. Secretary, R. B. Crosland, Jr., 1001 S. Marshall St., Winston-Salem.

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Northeastern Oklahoma: Organized, 1948. Headquarters, Tulsa, Okla. President, W. R. Lee, 303 Beacon Bldg., Tulsa 3. Secretary, R. F. Shoemaker, 1136 So. Peoria, Tulsa.

Northern Ohio: Organized, 1916. Headquarters, Cleveland, Ohio. Meets, Second Monday. President, W. R. Moore, 5005 Euclid Ave., Cleveland. Secretary, John Richmond, 10210 Woodland Ave., Cleveland 4.

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South Texas: Organized, 1938. Headquarters, Houston, Tex. Meets, Third Friday. President, C. C. Quin, 809 Stuart Ave., Houston 6. Secretary, R. J. Salinger, 4510 Dewberry Lane, Houston 4.

Southern California: Organized, 1930. Headquarters, Los Angeles, Calif. Meets, Third Wednesday. President, R. S. Farr, 2615 Southwest Dr., Los Angeles. Secretary, L. J. Helms, 633 S. Berendo St., Los Angeles 5.

Southwest Texas: Organized, 1946. Headquarters, San Antonio, Tex. President, G. R. Rhine, 1208 Alamo National Bldg., San Antonio. Secretary, I. W. Wilke, 422 Congress Ave., Austin.

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Utah: Organized, 1944. Headquarters, Salt Lake City, Utah. Meets, First Wednesday. President, E. J. Watts, 2485 Douglas St., Salt Lake City 5. Secretary, R. H. East, 326 E. First So., Salt Lake City.

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Virginia: Organized, 1946. Headquarters, Norfolk, Va. President, J. E. White, 7607 Gloucester Ave., Norfolk 5. Secretary, D. E. Phillips, P. O. Box 674, Newport News.

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Washington, D. C.: Organized, 1935. Headquarters, Washington, D. C. Meets, Second Wednesday. President, A. S. Gates, Jr., 621 N. Jackson St., Arlington, Va. Secretary, J. G. Muirheid, 2013 New Hampshire Ave., N. W., Washington 9.

Western Michigan: Organized, 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. President, H. W. Wolters, 820 Staples Ave., N.W., Kalamazoo 54. Secretary, H. R. Limbacher, 760 E. Vine St., Kalamazoo.

Western New York: Organized, 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. President, Edwin Woolcock, 2217 15th St., Niagara Falls, N. Y. Secretary, T. F. Killeen, 374 Delaware Ave., Buffalo 2.

Wisconsin: Organized, 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. President, W. A. Ouweneel, 514 E. Ogden Ave., Milwaukee 2. Secretary, H. F. Brinen, 2226 Kinzie Ave., Racine.

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North Carolina State College: Organized 1948. Headquarters, Raleigh, N. C. President, J. G. Marshall, North Carolina State College. Secretary, Basil Greene, Apt. D-2, Grosvenor Garden Apts., Raleigh.

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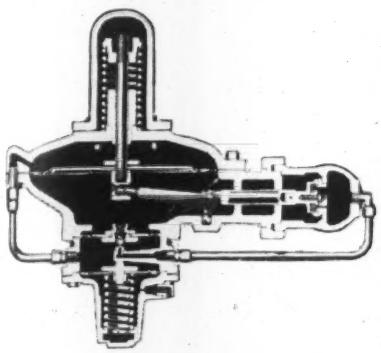
Texas A. & M. College: Organized, 1946. Headquarters, College Station, Tex. Meets, Third Thursday. President, C. V. Brown, Mech. Engrg. Dept., Texas A. & M. College, College Station. Secretary, R. S. Hughes, Box 914, College Station.

EQUIPMENT DEVELOPMENTS

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1949 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk equipment and manufacturer not listed.

Stable Operation Features Gas Pressure Regulator

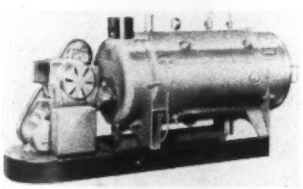


No. 3965—The type 99 multi-purpose gas pressure regulator is said to be the result of nine years of development and research and is now available from Fisher Governor Co., Marshalltown, Iowa.

Chief feature, according to the manufacturer, is extremely stable operation over the entire range of pressure and volume so that the unit may be used for many types of installations.

It is offered in 2 in. screwed pipe thread connections only and is designed for inlet pressures up to 150 psi and for reduced pressures from 4 oz to 50 psi. The regulator capacity is from 0 to 143,000 cu ft per hr and, due to the special internal construction and pilot construction, it is said to maintain a constant reduced pressure on all flows from zero to maximum.

Hot Water Heating Boiler Has Four Pass Construction



No. 3966—A hot water heating boiler, said to be ideal for panel, gravity, or forced feed applications, is now available from Cleaver-Brooks Co., 326 E. Keefe Ave., Milwaukee 12.

Offered in three sizes, 250,000, 550,000, and 730,000 Btu per hr output, it is completely automatic and may be fired by either oil or gas. Four pass construction of the boiler shell is said to insure high rating and high efficiency (over 80 percent). Minimum design pressure is 100 psi and, according to the company, the unit is suitable for high temperature or pressure applications.

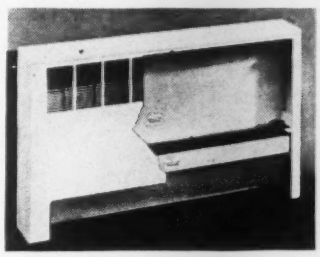
A hinged rear door lined with refractory is used to provide accessibility for cleaning and maintenance. The front end of the base, including the burner, can be removed for separate handling, though the unit can be passed through a standard door opening. It is constructed in accordance with the ASME code.

Temperature, Pressure Recorders Designed for Easy Installation

No. 3967—The line of gas filled temperature recorders and recording pressure gages made by Penn Industrial Instrument Corp., 3116 N. 17th St., Philadelphia 32, includes instruments with one, two, three, or four pens and is designed for easy field installation of the actuating system and pen mechanism. This feature, says the manufacturer, facilitates the conversion of a one pen recorder to a multiple pen instrument.

Temperature tube systems feature an all-stainless steel welded construction with an improved design of spiral spring. A standard bulb design is arranged so that it can be converted in the field into any of the usual apparatus connections.

Convector-Radiators Incorporate Copper Tubes and Aluminum Fins



No. 3968—The type F convector radiators recently developed by Fedders-Quigan Corp., Buffalo 7, N. Y., are available in 4, 6, 8, and 10 in. widths and lengths up to 64 in. They are designed for use with steam and gravity or forced hot water systems and have formed steel cabinets with a removable front panel which has integral stamped louvers. The cabinets may be used for either free standing or semi-recessed installations.

Heating elements have copper tubes expanded into headers with heavy ferrules power-driven into tubes. Fins are of aluminum and have die formed collars which are said to provide large heat transfer contact between tubes and mechanically bonded fins. The cast headers are arranged for piping connection at either end, top, or bottom.

Compound Protects Metal During Brazing and Silver Soldering

No. 3969—"Anti-Capillary Compound" has been developed by Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y., for use with low temperature welding rods.

This paste is designed to confine the flow of molten

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(Circle each number in which you are interested)

3965	3966	3967	3968	3969	3970	3971	3972	3973	3974
3975	3976	3977	3978	3979	3980	3981	3982	3983	3984
7119	7120	7121	7122	7123	7124	7125	7126	7127	7128
7129	7130	7131	7132	7133	7134	7135	7136	7137	7138
7139	7140	7141	7142	7143	7144		7146	7147	7148
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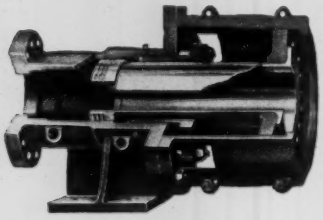

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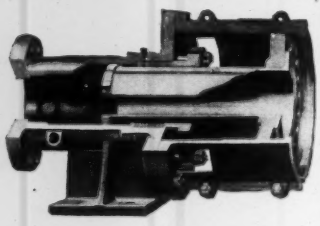
An outstanding joint. Piston-Rings hold the line pressure. No shut-down for servicing.



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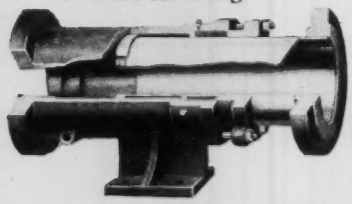

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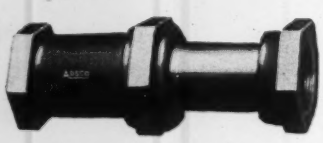

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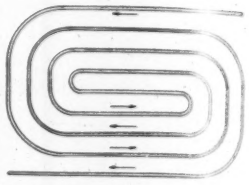
alloys to the limited area upon which the weld is to be applied. According to the company, the compound protects the parent metal from discoloration at welding temperatures and reduces the possibilities of distortion, as the temperature is confined to the specific area under consideration. In addition, the material is said to help limit the flow and retain the molten metal to that area being welded.

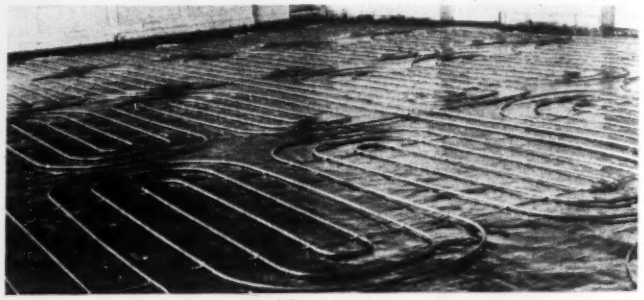
The paste can be used with an oxyacetylene torch, a soldering torch, a soldering iron, a furnace, and high frequency applications. It may be applied by painting or spraying and may be removed by mechanical action, quenching, wire brushing, or sandblasting.

Prefabricated Coils Designed for Uniform Panel Temperatures



No. 3970—Even-Ray Co., Inc., 93 Tiffany Blvd., Newark 4, N. J., is offering a line of radiant heating coils which features an arrangement so that supply piping alternates in position with the return. This, says the company, provides for an even output and uniform panel temperatures.

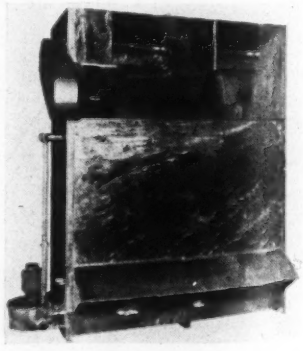
Machine formed and made of type L hard tempered copper with joints silver brazed, the coils are spaced and held in position by metal separator bars which can



be left in place or removed in the field. Large, easy bends are said to reduce flow resistance so that long lengths of tubing for circuits, small mains, branches, and returns may be used.

A wide variety of coil sizes is available and tubing sizes used include $\frac{3}{8}$, $\frac{1}{2}$, and $\frac{3}{4}$ in.

Prime Surface Coils, Galvanized Steel Parts Used in Condenser



No. 3971—The new evaporative condenser developed by Acme Industries, Inc., Jackson, Mich., incorporates prime surface pipe coils and is assembled with stainless steel nuts, bolts, and screws. All steel parts, including wheels, scrolls, and the base sump, are hot dip galvanized after fabrication.

Included in the base sump is a "Micromet" water treatment basket for use where the available water may cause scale and corrosion. All AP and FP models are built with $\frac{3}{4}$ in. steel pipe coils and FC models are made with copper tubing coils.

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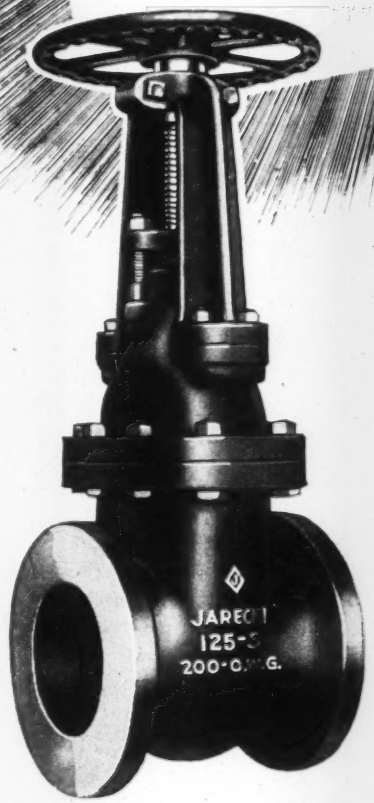

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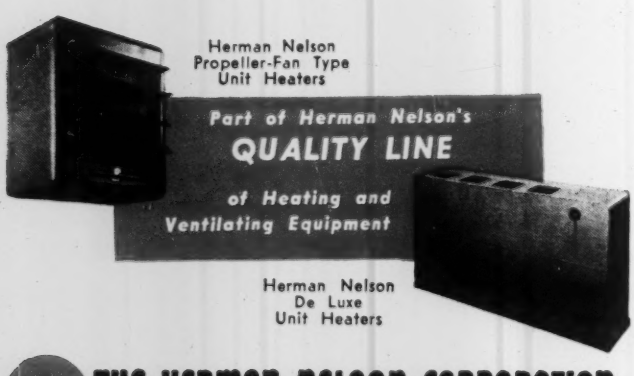
Yes, quality products, prompt service and intelligent cooperation have built an enviable reputation for Herman Nelson Dealers everywhere. They will do the same for you. Get the details from your nearest Herman Nelson Distributor today.



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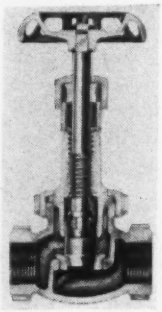
MOLINE, ILLINOIS

Recommends 300 lb Globe Valve for Severe Steam Service

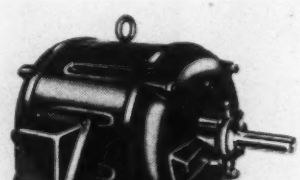


No. 3972—A new plug type bronze globe valve for 300 lb service, Fig. 976-A, has been developed by Jenkins Bros., 80 White St., New York 13. It is said to be especially suited to services such as pressure regulation, steam control bypass lines, temperature regulation, apparatus throttling, bleeds, drips and drains, soot blowers, continuous blowdowns, or any other close regulation of steam. It is recommended for severe services of the type frequently found in dye houses, bleacheries, breweries, oil refineries, packing houses, tanneries, food, rubber and chemical plants.

Plug and seat ring of JX500, a special alloy stainless steel, heat treated to give 500 Brinnell hardness plus extraordinary ductility, are said to make an ideal combination which is practically impervious to wear. The "Slip-on Stay-on" plug is simple in design, with a Tee slot for engaging the spindle head. Another advantage, says the company, is the design of the spindle, made of hard, tough aluminum bronze. Large in diameter, it has an exceptionally long (15.9 in.) thread and nine threads are in contact at all times.

The valve is available in sizes ¼ to 2 in.

Drip-Proof Design Applied to Larger Motors

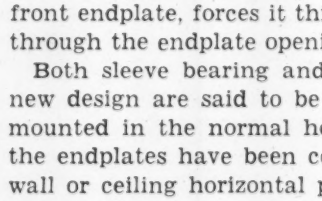


No. 3973—Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, which has built drip-proof motors in frames 225 and smaller for many years, has adopted the same design for its polyphase motors in the 254, 284, 324 and 326 frames.

Differing only in the omission of all ventilating openings, the new frames are formed of heavy rolled steel, shaped to center the stator core and to provide passages between the frame and the core for ventilation. An auxiliary fan draws air through the openings in the front endplate, forces it through these passages and out through the endplate openings on the drive end.

Both sleeve bearing and ball bearing motors of the new design are said to be completely drip-proof when mounted in the normal horizontal position and, when the endplates have been correctly rotated, in the sidewall or ceiling horizontal positions as well.

Forming Machines Roll Sheet Metal, Light Plates



No. 3974**—The "Lown" slip roll forming machine, model B-600, is a newly designed unit having 6 in. diameter rolls and is said to be ideal for handling heavier gages of sheet metal and light plates. Offered by San Angelo Foundry & Machine Co., 1000 E. Upton, San Angelo, Tex., the ma-

A&R Products for—

Air Conditioning • Humidifying • Dehumidifying

Cooling • Scrubbing • Air Washing • Air Purification

CAPILLARY AIR CONDITIONERS

A standard Factory Insulated Size 6-5 Class 1 Capillary Central Station Air Washer. Normal capacity 30,000 cfm.

The Capillary Air Conditioner, designed to act as an air washer, dust arrester, humidifier, cooler and dehumidifier, depends on the new and far more efficient principle of dividing *both* the water and air of the system into fine streams flowing together through low resistance channels. It provides the most intimate and efficient contact between air and the cooling, moistening or cleaning fluid with unique economies in operating costs.

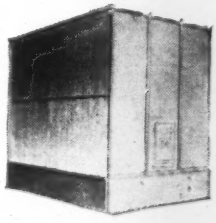
For most purposes, a Capillary Air Washer requires only 1 3 the volume of water at 1 3 the pumping pressure used by conventional equipment. These Capillary conditioners are available with casings and tanks factory insulated for central station air conditioning applications.

CAPILLARY UNIT CONDITIONERS are factory insulated and assembled, ready for use. They include fan, motor, drive, heating coils, Capillary Cells with suitable sprays, spray pump and mixing dampers. Units are designed for floor mounting or ceiling suspension, and can be arranged for the reception of cooling coils if required.

Capillary Air Conditioners are covered in complete detail in Bulletin G-3.

SPRAY TYPE AIR WASHERS

A & R Type S Air Washers conform to the usual basic design of spray washers, with many special features developed to insure more efficient and more dependable operation, lower maintenance costs and in most cases, lower installation costs. Unique design features include more efficient and more easily handled eliminators; collecting tanks which are much more readily cleaned; flooded entering baffles for excessively dirty air and more effective nozzle arrangement.



Standard A & R Spray Type Washer — Factory Insulated.

Type S Air Washers can be supplied with factory insulated casings and tank for central station applications.

Bulletin AW-1 provides complete description and engineering data.

SPRAYED COIL DEHUMIDIFIERS

A & R Sprayed Coil Dehumidifiers for year-round treatment of air are complete with water type or direct expansion cooling coils, sprays, circulating pump and glass mat eliminators. They are factory insulated complete units ready for speedy field assembly. Special design features insure continuous washing and cleaning of finned surfaces and easy accessibility of parts.

See Bulletin SC-1 for complete data.

ARTICULATED UNITS

No matter how large the air conditioning system, A & R can supply an integrated or articulated control apparatus to meet specific needs. Where equipment is of such size that it cannot be shipped assembled, the importance of using matched and integrated central station conditioners, heating and cooling coils, fans, motors, drives, automatic dampers, fan housing and air inlet chambers, ready for assembly, cannot be over-emphasized. Over-all cost is materially reduced, while the responsibility for delivery and performance rests on one purchase order to one organization.

A & R INSULATED PANELS

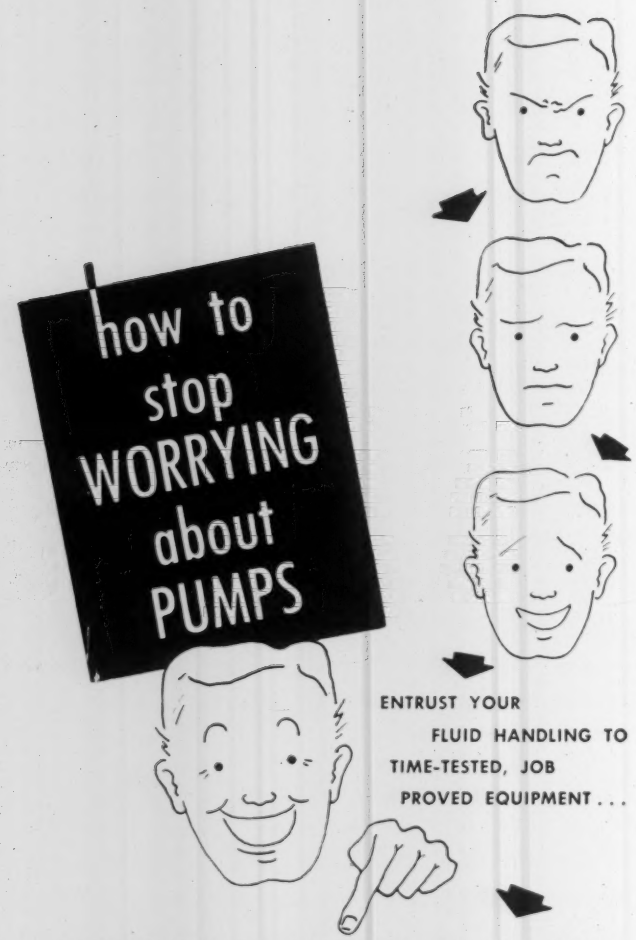
These factory-produced panels consist of insulation between a metal sheet on one side and hard fiber board on the other, the three elements being laminated and cemented together under pressure. Their design includes the structural frame to form units which require only bolting together to make enclosures of any required shape for plenum chambers, air washers and many other purposes. Panels are available in widths from 3" to 48", and in lengths up to 12'. Their use insures tremendous economies in field labor.

For details see Bulletin P-1.

A typical example of A & R Panels forming a Plenum Chamber.

AIR & REFRIGERATION CORP.

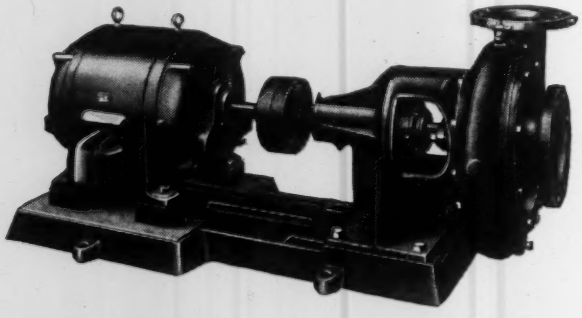
475 FIFTH AVENUE, NEW YORK 17, N.Y.



WEINMAN CENTRIFUGAL PUMPS

With a Weinman Pump on duty you can give your full attention to other plant problems, for Weinman Pumps take care of themselves. Their sturdy construction, advanced design and efficient operation guarantees overall pumping economy.

If your plant handles liquids in any form it will pay you to talk "pumps" with Weinman. A letter, wire, or telephone call will get the prompt attention of a centrifugal specialist — anxious to be of service.



Weinman Type GB and KB Pumps available with or without leak-proof mechanical shaft seals. Heads up to 200 ft. Capacities up to 1100 GPM.

Built by Centrifugal Specialists

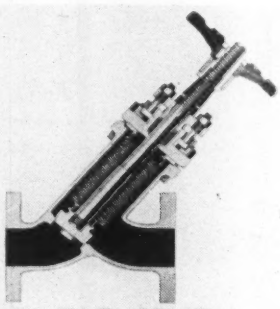
The WEINMAN Pump Mfg. Co.

284 Spruce Street • Columbus 8 • Ohio

chine is of the initial or pinch type and has all rolls driven through a swing link gearing designed to facilitate the forming of small cylinders and the rolling of light gages of polished steel. This machine can be furnished with power adjustment on the rear or bending roll, with an air cylinder attachment for raising and lowering the drop end bearing, and with a transmission unit to provide variable speeds. Six sizes are available for handling maximum thicknesses from approximately ⅛ to 7/16 in.

The model B-400 machine, shown here, is also a power driven unit having essentially the same features and incorporating 4 in. rolls. It is also available in six sizes for handling maximum thicknesses of sheet metal from 10 to 20 ga.

Welded Alloy Bellows Seal Valve Stems

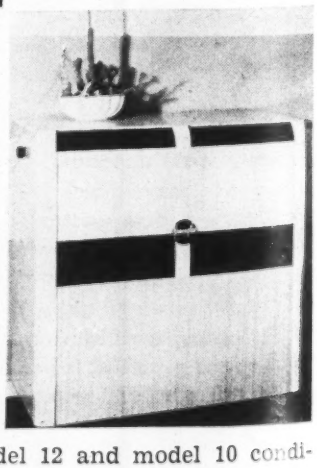


No. 3975 — MagniLastic Div., Cook Electric Co., 2700 Southport Ave., Chicago 14, has developed a standard series of welded bellows for sealing valve stems against corrosive, explosive, poisonous, or inflammable liquids and gases. Units are designed for use with a wide range of valves available from other companies, as this firm does not make valves.

As shown here, the bellows, which is available in nickel, monel, stainless steel, inconel, and other weldable metals, completely surrounds the lower part of the valve stem and is welded at the top end to a collar which fits into the body neck and at the lower end to the top of a disc. The formed metal diaphragms of the bellows are welded alternately at their inner and outer circumferences.

According to the company, assemblies are tested to individual valve manufacturers' specifications and, for vacuum services, are offered with leak rates less than 1 micron per cfh. Offered in a range of sizes for valves from ½ to 12 in., the bellows are said to have withstood fatigue tests of a million cycles.

Expanded Line of Room Conditioners Includes Many Types and Sizes



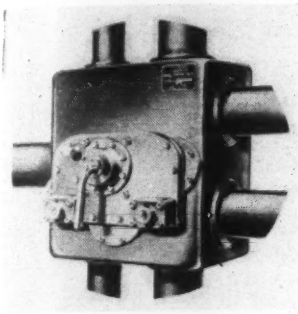
No. 3976—A total of 10 models constitute the expanded line of room air conditioners offered by Remington Air Conditioning Div., Remington Corp., Cortland, N. Y.

Shown for the first time at the recent Chicago heating, ventilating, and air conditioning show, the line includes both console and window sill types, air cooled and water cooled units for a-c or d-c use, and remote installation units. The model 12 and model 10 condi-

tioners are both air cooled console types, the former is rated at 1¾ hp and is designed to have a cooling capacity from 12,300 to 13,500 Btu per hr. The latter, a 1¼ hp unit has a capacity of 10,000 to 11,000 Btu per hr. In both models optional heating (7000 Btu per hr) is available and imported wood cabinets are featured.

Other units include two air cooled window sill types, ½ and ¾ hp, two water cooled console models, 1 and 1¼ hp, and four remote installation units, 1 to 1¾ hp, for either air or water cooling.

Single Control Valve Operates Zeolite Softeners, Pressure Filters

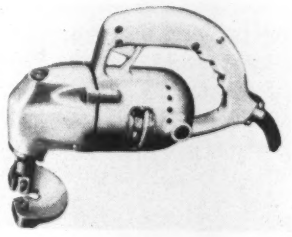


No. 3977—A single control valve for the simplified operation of all types of zeolite softeners, ion exchange systems, and pressure filters is said to reduce the time required by the plant operator and to minimize the possibility of faulty operation through error in manipulation. This unit, the "Hydromatic" single control valve has been developed by Cochrane Corp., 17th St. & Allegheny Ave., Philadelphia 32, and is now standard equipment on its line of zeolite softeners and pressure filters.

Control of backwash, rinse, service, chemical feed, etc., is said to be greatly simplified as all operations are accommodated by a single valve. The device is, in effect, a six position valve with four normal operating positions and two standby positions.

According to the company, it is ideally suited to manual or automatic operation, and since the valve is pilot actuated (power for operation being provided by the raw water itself), gradual opening and closing of the valve members is possible, thus eliminating hydraulic shock.

Portable Electric Shear Cuts 12 Ga Sheet Steel



No. 3978*—Black & Decker Mfg. Co., Towson 4, Md., has added a new electrically driven shear to its line of "Porto-Shears." The new tool is designed to cut 12 ga standard sheet steel, approximately two gages thinner in monel metal and stainless steel, or approximately 50 percent above the rating in sheet copper, aluminum, lead, and other nonferrous metals.

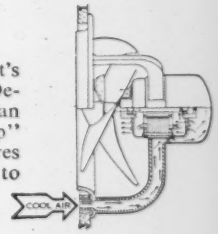
Said to be simple in design, lightweight, and sturdily constructed, it is designed to follow an irregular pattern as the cutting blade is always visible and will cut on a radius as small as 1½ in. Reciprocating action of the vertical blade against the stationary horizontal blade is provided by the company's universal motor which delivers 1100 strokes per min at full load.

The unit may be held in any position and the handle contains a release trigger switch with a locking pin for continuous use.

NEW TYPE "Q"
SELF-COOLED MOTOR PROPELLER FAN

ILG VENTILATION

It's NEW from motor cover to frame, yet it's proved in thousands of installations! Certified ratings testify to remarkable capacity. Decibel ratings vouch for amazingly quiet operation. All ILG's famous features for high efficiency, power-saving economy, minimum maintenance and long life are built in. Now available in all sizes up to and including 30" fan wheels. Hurry—get the complete story in ILG Catalog No. 148—send coupon or phone nearby Branch Office (consult classified directory).

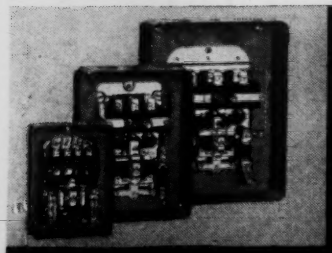


Specify the Self-Cooled Motor—it's exclusive, patented, ILG-built. Designed specifically for exhaust fan duty. Motor never "gums-up" from contact with foul air, requires minimum maintenance, adds to long life of entire unit.

ILG ELECTRIC VENTILATING CO.
2841 N. Crawford Ave., Chicago 41, Ill.
Offices in more than 40 Principal Cities

☐ Rush free copy of new Catalog No. 148

Firm Name.....
Individual.....
Address.....Zone.....
City.....State.....



WARD LEONARD
STARTERS

QUICKER TO INSPECT

because contactor parts are ACCESSIBLE

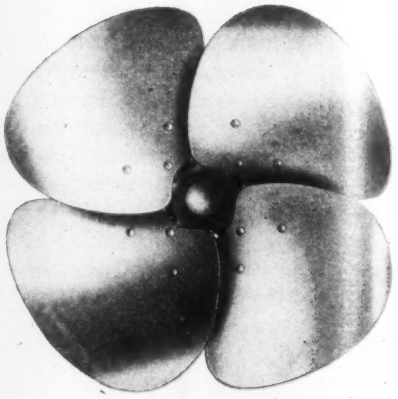
Removing a single key permits the entire moving contact assembly to be withdrawn for inspection of all main silver contacts, both moving and stationary.

And it's easier to replace main stationary contacts, too, due to the use of individual spring retaining clips.

Write for Bulletin 4110. It fully describes Ward Leonard's new Size 1, 2 and 3 across-the-line, non-reversing AC magnetic starters. Ward Leonard Electric Co. 24 South Street, Mount Vernon, N. Y. Offices in principal cities of U. S. and Canada.

WARD LEONARD ELECTRIC COMPANY
Result-Engineered Controls
RESISTORS • RHEOSTATS • RELAYS • CONTROL DEVICES

Fan Blades Designed for High Efficiency



No. 3979 — Outstanding efficiency is said to be the chief characteristic of the new line of "Hi-Eff" fan blades developed by Torrington Mfg. Co., 70 Franklin St., Torrington, Conn.

Although entirely new in design and forming, the blade does not need any greater space or other changes for operation and may be adapted to existing uses such as on space heaters, unit heaters, etc. —says the company. The line comprises both three and four blade construction, ranging in diameters from 10 through 20 in. and 8 through 20 in. respectively. There are five pitches in most diameters and blades are of aluminum. The spider and hub are of steel.

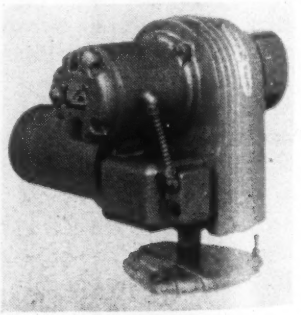
Dehumidifying Unit Removes Moisture by Adsorption

No. 3980—Automatic removal of moisture from room air and holding relative humidity at a predetermined level is the function of the new "Dryomatic Dry Conditioner" developed by Dryomatic Corp. of America, 17 E. 22nd St., Baltimore 18.

Among the many applications stressed by the company are the prevention of rust and corrosion in tool and stock rooms, the protection of food and other perishable materials from mold and moisture damage, the prevention of crystalline materials such as sugar and salt from caking and deliquescing, and the protection of delicate instruments and maintenance of controlled conditions in the laboratory.

After filtering room air, the unit removes moisture by adsorption, the moisture being blown off in the form of saturated air. Operation is said to be completely automatic and the capacity sufficient to control the moisture in a room of 5000 cu ft volume—holding a dew point of 0 F and a relative humidity as low as 15 percent. Batteries of these units are said to be effective for volumes up to 300,000 cu ft and special models for individual applications can be furnished.

Dual Nozzles Employed in Oil Burner



No. 3981 — New refinements in the "York-Heat" oil burner, model N-38, feature the use of dual nozzles to achieve a capacity from 5 to 10 gph while utilizing a conventional 1/6 hp motor, fan, and a pump speed of 1725 rpm, according to York-Shipley, Inc., York, Pa.

In this model, a somewhat larger fan is used and the dual blast tube has been eliminated except for a short

section used to support the nozzle pipe assembly. Greater interchangeability of parts with other N models is also claimed.

Electronic Smoke Indicators Control Overfire Air Jets

No. 3982—The photoelectric cell smoke indicators of Brooke Engineering Co., Inc., 4517 Wayne Ave., Philadelphia 44, have been adapted to control overfire air to prevent smoke in coal burning furnaces. A light beam projected across a boiler or furnace flue shines on a phototube which is used to measure smoke density. When the density increases beyond a predetermined amount, a red warning light flashes and a timer relay circuit is closed. This starts the overfire air jets which remain in operation for a preset time period.

Recorders and audible alarms can also be provided, and where desired, modulated control of continuous overfire air can be furnished. Other features stressed by the company include all aluminum, dust tight construction for the light source and eye box, a sealed lens and gasketed covers, and a built-in voltage regulator. The period of time during which the jets remain in operation may be adjusted from 20 sec to 20 min.

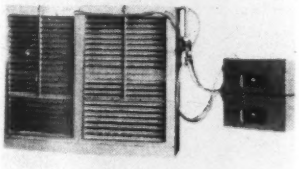
Motor and Turbine Type Pump Combined Into One Assembly

No. 3983—The motor and turbine type pump are combined into one assembly in a new 2 to 10 gpm pumping unit, the "Monobilt," available from Roy E. Roth Co., Rock Island, Ill.

Special features as listed by the manufacturer include replaceable heads and impellers, quiet operation, and a mechanical seal.

Units are offered in three standard constructions: bronze fitted, all iron, and all bronze. They are equipped with a single phase motor, 110-220 volt, 60 cycle capacitor type, with ball bearing construction, and a stainless steel shaft.

Electrostatic Cleaners Made to Customer Specifications



No. 3984—Trion, Inc., 1000 Island Ave., McKees Rocks, Pa., is now preparing commercial electrostatic precipitators to customer specifications. Specially constructed floor models, suspended cabinets, and large size filters for unusual applications can be furnished on request. Shown here is a 7200 cfm custombuilt unit.

The company has also added two new models to its "packaged" line. These air filters, "ready to install," are now available to handle air volumes up to 4000 cfm.

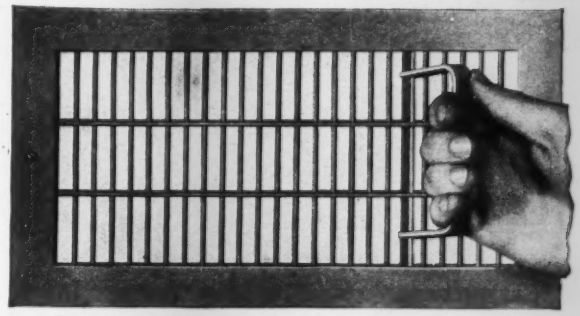
According to the company, units are guaranteed to remove more than 90 percent of the dust, dirt, smoke,

INDEPENDENT

"Fabrikated" WALL GRILLES for Commercial Installations

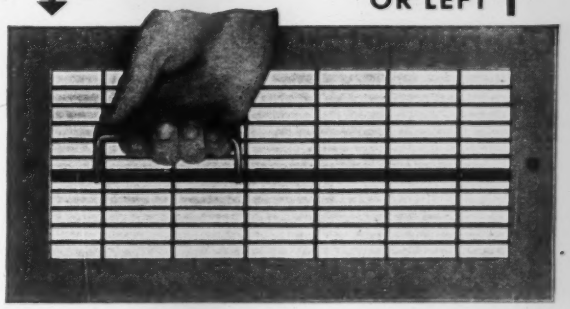
PROVIDE ADJUSTABLE DIRECTED AIR FLOW

321-A



UP OR DOWN

RIGHT OR LEFT



311-A

Made to fit openings in even inches from 8" x 4" to 60" x 40"

Independent Fabrikated* Adjustable Grilles (patented), rigidly constructed with stamped steel rims and steel bars, are made with either vertical or horizontal grille bars. Grille bars are *adjustable* before or after installation; available also with bars permanently set for straight flow.

Write for new Catalog No. 48—gives schedule of sizes, details and prices.

Always Leading — Always Progressing

*Reg. U. S. Pat. Off.

THE INDEPENDENT REGISTER CO.

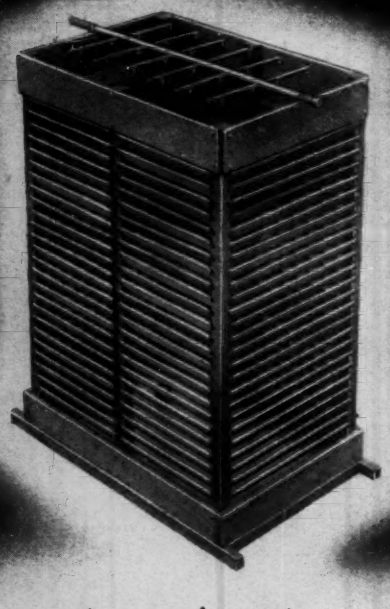
3747 E. 93rd STREET · CLEVELAND, OHIO

SPECIFY MARLEY

Series 100

FOR

SPRAY TOWER ECONOMY



For a water cooling tower that

Can be shipped immediately from stock
Is completely prefabricated
Has complete erection, operation and maintenance instructions
Is simple to operate
Uses patented Marley Spray Nozzles
Has a balanced spray system
Assures a minimum drift loss
Is made of California Heart Quality Redwood
Has a heavy steel basin plate and galvanized hardware
Is accurately sized with rating data
Has no nails or similar metallic fasteners
Features machined louver posts and slip fit louvers
Is fully backed by the Marley guarantee

Your best buy is the MARLEY SERIES 100 NATURAL DRAFT COOLING TOWER

Ask for a MARLEY Factory-Trained APPLICATION ENGINEER to tell you how the Series 100 will help YOU solve your water cooling problems. No

MARLEY COOLING TOWERS

THE MARLEY COMPANY, INC.

Kansas City 15, Kansas

soot, lint, pollen, and other airborne irritants from air streams passed through the filter.

Equipment Shorts

Johnson Service Co., Milwaukee, honored some 360 "Oldtimers," each having over 10 years of service with the company, at a number of dinners in cities throughout the country. ..... Revisions downward in some price extras of stainless steel products have been made by **Allegheny Ludlum Steel Corp.,** Pittsburgh. Reductions in quantity extras apply to all grades of all products except stainless tubes and castings. Stainless steel sheet gage extras have also been reduced in some cases. ..... **White-Rodgers Electric Co.,** St. Louis, has established a nationwide system of exchange agencies to furnish repair and replacement service and to provide information by furnishing catalogs, service manuals, and other data.

Spencer Thermostat Co., Attleboro, Mass., for years has been a wholly owned subsidiary of Metals & Controls Corp. Recently the company name was changed to **Spencer Thermostat Div., Metals & Controls Corp.** ..... The international student training program of **Harrison Pump and Machinery Corp.,** Harrison, N. J., is now in progress and is designed to create and maintain harmonious trade relations with foreign countries, as well as to provide technical training. The course in air conditioning and refrigeration equipment includes both foreign and domestic students who have qualified and who will assume duties in company offices or distributor organizations both here and abroad. ..... Incentive payments for the year 1948 totalled $3,821,973 at **Lincoln Electric Co.,** Cleveland. Payments were made to 1097 workers and, as an average, doubled the income of every member of the organization.

Permanente Metals Corp., Oakland, Calif., produced more than a quarter billion pounds of Kaiser aluminum last year, easily exceeding the company's 1947 output of 185 million pounds. Since the demand still exceeds the supply, two new plants will be opened this year: an aluminum foil mill at Permanente, Calif., and a rod, bar, and wire mill at Newark, Ohio. ..... Sealing washers, said to embody a new principle in construction, have been developed by **Franklin C. Wolfe Co.,** 407 Commercial Center St., Beverly Hills, Calif. Under the trade name "Lock-O-Seal" they are used around screws, bolts, rivets, tubing, electrical wires, etc. and are recommended for many applications including tanks, flotation gear, hydraulic systems, air conditioning apparatus, refrigeration equipment, compressors, etc., where a seal against air, gas, and liquid leaks is required. The unit is essentially a small doughnut shaped ring of sealing material encircled by a washer-like retainer.

"Eutectrode" 24/49 is offered by **Eutectic Welding Alloys Corp.,** 40 Worth St., New York 13, and is an electrode recommended for metal arc welding grey and alloy cast iron where preheating is impossible or undesirable. ..... The No. 60 "Dimensioner" template is made of cellulose nitrate and is designed to speed up dimensioning, lettering, etc. in all phases of drafting. The manufacturer is **Rapidesign, Inc.,** P. O. Box 592, Glendale, Calif.

WHO'S WHAT

Charles T. Perkins, former vice president in charge of engineering, has been elected president of **Modine Mfg. Co.,** Racine, Wis., and succeeds W. C. Winkel who died last year. **Arthur F. Thompson,** previously vice president, is now executive vice president and **Arthur G. Dixon,** secretary since 1943, has been elected vice president and secretary. Other vice presidents re-elected are **G. H. Jackson,** in charge of purchasing and **Robert Grant,** in charge of manufacturing. **A. B. Modine,** founder of the company, continues as chairman of the board and **E. G. Rutherford** has been re-elected treasurer.

The new president of **Air-Maze Corp.,** Cleveland, is **Oliver H. Schaaf,** formerly vice president and general manager. **A. E. Schaaf,** president for nearly 25 years, has been made chairman of the board. **R. S. Purinton** is now factory representative covering Ohio, Kentucky, and West Virginia. . . . **A. B. Stickney,** a past national president of the American Society of Refrigerating Engineers, has resigned from **Armour & Co.,** Chicago, and is now with **The Rust Engineering Co.,** Pittsburgh. . . . **McQuay, Inc.,** Minneapolis, has elected **Philip S. Morris** executive vice president and **H. Blake Thomas** vice president in charge of sales. **R. W. Schreiber,** 820 Battell St., Mishawaka, Ind., is company refrigeration representative in Wisconsin, northern Illinois, northern Indiana, and Michigan. **Ted Stikeleather,** refrigeration representative in the Cincinnati area, is now covering a larger territory which includes western New York, western Pennsylvania, and the entire states of Ohio, West Virginia, and Kentucky.

Earl L. Bedard, sales manager of **Mt. Hawley Mfg. Co.,** Peoria, Ill., is now vice president and will continue to direct national sales and advertising programs. . . . Sales of welding positioners and turning rolls manufactured at the **Worthington Pump and Machinery Corp.,** Dunellen works, are now being supervised by **Frank J. Whelan,** vice president, with headquarters at the firm's executive offices, Harrison, N. J. He continues to supervise sales of standard pumps, compressors, and mechanical power transmission equipment sold through industrial and oil field distributors, as well as to equipment manufacturers. **F. J. Connolly** continues as manager of the welding positioner and turning roll sales division, and **A. B. Kime** remains eastern regional supervisor, both operating from the Dunellen works. **P. J. Patton, Jr.,** continues as central regional supervisor at the Chicago district office.

Young Radiator Co., Racine, Wis., has added **National Requirements Service,** Dayton, Ohio, to its list of representatives. The move was made to obtain specific representation at the Wright-Patterson air force base. **Gordon Davisson,** who recently joined the Young staff, is engaged in field and service work. . . . **Edward R. Legg,** president, Refrigeration Corp. of America, has been elected to the board of directors of the **Air Conditioning and Refrigerating Machinery Association, Inc.** . . . **Dravo Corp.,** Pittsburgh, has named the **Superior Coal, Coke & Fuel Oil Co.,** 919 Wells St., Fort Wayne, Ind., as distributor of its air

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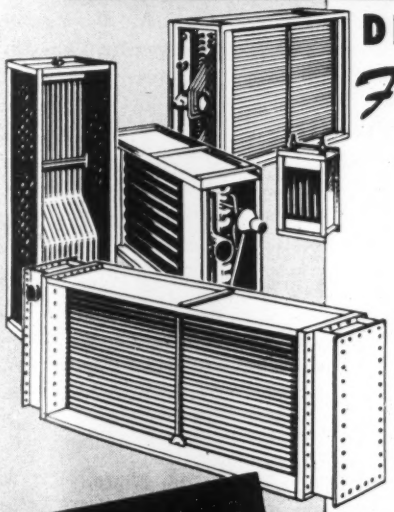

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heaters in northeastern Indiana. . . . **Charles L. Hallup**, with headquarters in Reading, Pa., is the new sales manager of field operations for **Reading-Pratt & Cady**, Div. of **American Chain & Cable Co., Inc.**, Reading.

The new special sales representative in New York City for **Baker Ice Machine Co., Inc.**, South Windham, Me., is **H. H. Paltridge**, formerly chief engineer and general manager of the Goodsell Corp. He is specializing on consultation, planning, and engineering work for all phases of industrial and commercial air conditioning and refrigeration. . . . **Acme Industries, Inc.**, Jackson, Mich., has named **Alwin B. Newton** director of sales. He was previously chief engineer and chief development engineer for the Airtemp Div., Chrysler Corp. and before that served eight years with Minneapolis-Honeywell Regulator Co. as manager of its refrigeration division.

E. M. Ford, who has been with **Penn Electric Switch Co.**, Goshen, Ind., for 18 years, is now district manager of the company's Los Angeles territory. He had been assistant advertising manager. . . . Formerly assistant treasurer and auditor, **Hal M. Cranston** is now comptroller of **Owens-Corning Fiberglas Corp.**, Toledo. He joined the company at the time it was founded in 1938 as general supervisor of accounting. . . . **Allegheny Ludlum Steel Corp.**, Pittsburgh, recently created a new vice presidency and appointed **Robert M. Arnold** to that position. He has served as a director since 1946 and is president of Arnold Engineering Co., Chicago, a wholly owned subsidiary. . .

Sales representation in Cleveland for **Fitzgibbons Boiler Co., Inc.**, New York, is being handled by **Thermal Products Co.**, 4501 Prospect Ave. **A. L. Eubank**, vice chairman of the Kentucky State Engineers Examining Board, is representing the company in Louisville. . . . **Fedders-Quigan Corp.**, Buffalo, has opened a Chicago office for its heating division in the Madison Terminal Bldg. It is in charge of **Raymond H. Kelley**. . . . Formerly general manager, Atlas Mineral Products Co., **A. M. Younger** is manager of southwestern sales for **Wolverine Tube Div., Calumet and Hecla Consolidated Copper Co.**, Detroit. He succeeds **L. G. Fox** who has returned to the home office for special assignment duties. **J. L. Young, Jr.**, with headquarters in Houston and **A. S. Williams**, who will operate from Dallas, are representing the company throughout Texas, Oklahoma, Arkansas, and Louisiana.

Robert A. Wilson, well known in the heating field for 20 years, has succeeded the late M. R. Hamlin as the Columbus, Ohio, representative for **Warren Webster & Co.**, Camden, N. J. . . . **Kenneth A. Weatherwax**, vice president and general manager, Acme Industries, Inc., has been elected vice president of the **Air Conditioning and Refrigerating Machinery Association**. . . . Two new district offices have been opened by **Remington Air Conditioning Div., Remington Corp.**, Cortland, N. Y. The Philadelphia office at 2100 Arch St. is headed by **Moise Johnson** and the Dallas office, under the management of **William H. Moler**, is located at 2523 McKinney Ave.

Ernest R. Habicht, former manager of the Belle, West Virginia, works of **E. I. du Pont de Nemours & Co., Inc.**, Wilmington, Del., is now production manager of the ammonia department, with headquarters in Wilmington.

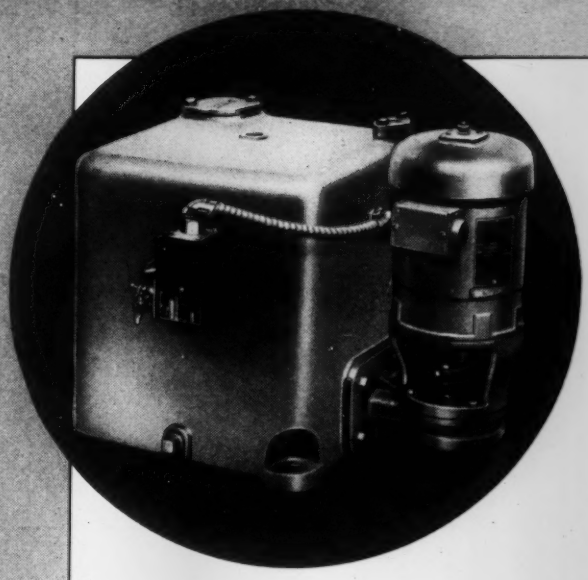
Fred **A. Otto** has been promoted from assistant manager to manager of the Belle works and **John R. McConnell**, former production superintendent, has taken over Mr. Otto's former position. . . . **Frank T. Settle** is a field sales engineer for **Fred H. Schaub Engineering Co., Inc.**, Chicago. . . . Recent personnel changes in the **Bryant Heater Co.**, Cleveland, include the promotion of **J. H. Swallow** to southern district sales manager, with headquarters at the company factory in Tyler, Tex., and the appointment of **R. A. Bissell** as assistant sales promotion manager.

Harold F. Smiddy has been elected a vice president of **General Electric Co.** and will continue as general manager of both the air conditioning and chemical departments. A former partner in the firm of Booz, Allen and Hamilton, industrial management consultants, he joined the company a year ago as a member of the president's staff. He is well known in the utility field, having served as a director and head of the operating and sales department of Ebasco Services, Inc. Earlier, he was an executive of Electric Bond and Share Co. Recently elected a commercial vice president, **Ralph M. Darrin** has been assigned to customer relations work in the New England territory, with headquarters in Boston. He was formerly manager of the apparatus department's central station divisions at Schenectady. **E. S. McKay** is now advertising and sales promotion manager of the air conditioning department and **Paul M. Augenstein** is sales manager for the company's water heaters.

Formerly Detroit district manager, **Harold H. Leonard** is now equipment division sales manager, **Delco Appliance Div., General Motor Corp.**, Rochester, N. Y. **Carl T. Amrine**, who was previously in the service department, is assistant sales manager in the equipment division. . . . **Binks Mfg. Co.**, Chicago, has elected **Joseph D. Linehan** to fill a vacancy on its board of directors. He is president of the Continental Plastic Corp., Chicago. . . . Serving the Los Angeles and central California area, **Vaughan Electric Service, Inc.**, is a distributor for **Typhoon Air Conditioning Co., Inc., Div. of Ice Air Conditioning Co., Inc.**, Brooklyn.

Re-elected for another term, **Otto A. Wendt** is president of the **Ventilating and Air Conditioning Contractors Association of Chicago.** . . . **Claude M. Lamb** is now sales manager of the industrial v belt division and assistant to the vice president in charge of mechanical sales of **Dayton Rubber Co.**, Dayton, Ohio. He has been with the firm for the past 10 years and is succeeded as New York district sales manager by **R. S. Gove**, an industrial division field representative in the New England territory for the past six years. . . . Bringing a background of more than 20 years in the refrigeration field to **Hajoca Corp.**, Philadelphia, **R. B. Davis** has joined the firm as assistant manager of its refrigeration division.

The newly formed building products division of **Great Lakes Carbon Corp.**, New York City, is in charge of **Thurman C. Carter**, recently elected vice president. He was formerly an officer of the Eagle-Picher Co. . . . **Sidney A. Whitt**, well known for his developments and contributions to the refrigeration and air conditioning field, is now vice president for engineering, **Cordley & Hayes**,



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New York City. He has been director of engineering for the past four years. . . . **Midwest Research Institute**, Kansas City, Mo., has appointed **Dr. George E. Ziegler** director and **Dr. Clayton O. Dohrenwend** assistant director. Dr. Ziegler came to the organization at the time of its inception in 1945 as executive scientist, having previously been associated with Armour Research Foundation, Chicago. Dr. Dohrenwend has been a research consultant at the institute since 1946 and was formerly with Illinois Institute of Technology as director of the mechanics department.

After 26 years of continuous service, **R. F. Calloway**, manager of the Detroit branch office, **Frigidaire Div., General Motors Corp.**, Dayton, Ohio, has retired. He is succeeded by **J. H. Moloney**, assistant branch manager. . . . **Link-Belt Co.**, Chicago, has named **R. E. Whinrey** and **L. C. Heinlein** as assistant general manager and superintendent respectively of its Dodge plant in Indianapolis which is devoted to the manufacture of ball and roller bearings. Both men started at the plant about 25 years ago. . . . Working out of the Columbus, Ohio, office of **Bituminous Coal Research, Inc.**, Pittsburgh, **Emerson B. Priest** is a new field representative assisting manufacturers, distributors, and service men in marketing and installing smokeless, small size heating equipment.

Joseph Heitman has joined **Anderson & Litwack Co.**, Chicago ventilating and air conditioning contractor, as chief engineer. . . . Advertising and sales promotion work of **Lau Blower Co.**, Dayton, Ohio, is being handled by **Edward V. Sullivan**, former advertising agency account executive. . . . Appointments to branch offices of **Manning, Maxwell & Moore, Inc.**, Bridgeport, Conn., include **Clifford E. Mathewson** to the Pittsburgh district office, **John R. Parsons** to the New York City office, and **A. C. Stauch** to the Chicago branch. . . . **Carl W. Fenninger**, **Walter Geist**, and **John S. McMartin** have been re-elected to the board of directors, **York Corp.**, York, Pa., for a term of three years. Newly elected officers are **J. K. Louden**, vice president and assistant to the president, **J. G. Bergdoll**, vice president and works manager, **J. C. Consley**, vice president and chief engineer, **W. F. Lynne**, assistant secretary.

Sam Tour & Co., Inc., New York City consulting engineer, has augmented its staff by the addition of **Robert E. Barnett** who has had extensive experience in atmospheric sampling and analyses and who was formerly chief of the chemical test branch of the Army chemical center at the Edgewood Arsenal, Md. . . . The new quality manager of all plants of **SKF Industries, Inc.**, Philadelphia, is **C. S. Gotwals** who installed the firm's quality control system during the war and who served as chief of inspection and quality control before becoming superintendent of the main Philadelphia plant in 1944. **Charles R. Scott, Jr.**, in charge of the machining division since 1946, succeeds Gotwals as superintendent and **W. F. Shedinger** now heads the machining division.

Automatic Switch Co., Orange, N. J., has named **F. P. Spinelli** manager of its switch department and **R. F. McCormick** manager of solenoid valve sales. Both men have been with the company for many years.

NEW BOOKS & REPORTS

Gives Data for Finding Economical Use of Refrigerant Condensing Water

Effective and economical use of water for removing heat in refrigeration condensers is becoming increasingly important because of limited supplies and sewer facilities in certain areas. In a paper, Economical Use of Condenser Water in Compression Refrigeration Systems, Leon Buehler, Jr., chief refrigeration engineer, Creamery Package Mfg. Co. and Andrew P. Boehmer, associate professor, State University of Iowa, show how it is possible to determine condensing temperatures for minimum cost of operation when the water cost is known, or when the full cost of water is in its pumping.

Previous works of the authors indicate that in the operation of a water cooled refrigeration condenser, there is one quantity of water which, when circulated, will give the minimum overall operating cost. In a series of articles (September and October 1946 issues, HPAC) Mr. Boehmer stated that the most economical condensing pressure is independent of the actual inlet water to the condenser, but is dependent on the rise in temperature through the condenser. This paper correlates the data previously given, expands it, and contains additional remarks on getting the most out of water.

A number of curves are given for determining economical operating conditions, both for city water and when water is pumped. In the case of pumping cooling water, the curves indicate that the economical water rise is not too critically affected by changes in evaporating temperature but that overall pump and motor efficiencies play an important part.

The use of water cooled subcoolers is given considerable attention and an example is used to show how a 10 percent saving in power could be effected, together with a reduction in the amount of water used. Other solutions to the water problem briefly mentioned include returning condenser water to city mains and recharging the ground with water taken from it. As stated by the authors, the use of cooling towers and evaporative condensers is considered beyond the scope of this paper which was presented before the last annual meeting of the American Society of Refrigerating Engineers, 40 W. 40th St., New York 18, and which has been preprinted.

Standardizes Tests for Bituminous Stoker Coals

Many contributions have been made by individual laboratories in regard to testing coal used in bituminous underfeed stokers of the smaller sizes and classes. Because of variations in approach, procedures, and test equipment, the results have rarely been comparable. As a result, the Stoker Manufacturers Association and Bituminous Coal Research, Inc. have jointly prepared a Tentative Standard Procedure for Testing and Evaluating Bituminous Stoker Coals.

The booklet includes drawings and descriptions of various components of the test equipment and samples of standard forms for recording and reporting test data and results. Detailed specifications are shown for standardized equipment requiring local fabrication, and a major item in this category is the test furnace.

Simple and effective, this Patterson System is ideal for defrosting installations having two or more evaporators in one refrigeration system. Operations are cyclic and can be either automatic or manually controlled. In addition to properly defrosting each evaporator, this PATTERSON SYSTEM protects the compressor by intercepting any slugs of refrigerant and changing the liquid into gas. It precools the refrigerant. It promotes higher efficiency in the system.

With proper modifications, usually it can be applied to the defrosting of a system with only one evaporator.

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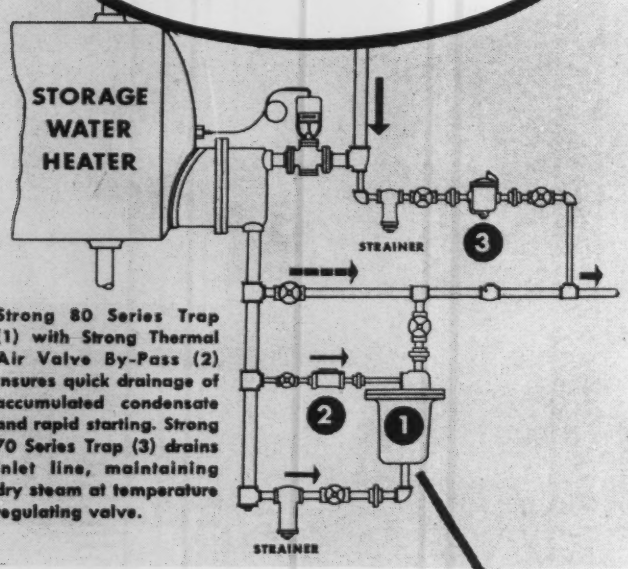

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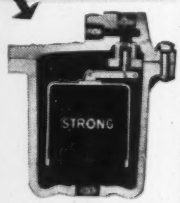
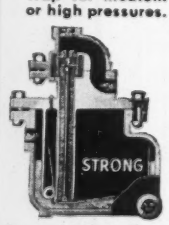


Strong 80 Series Trap for medium or high pressures.



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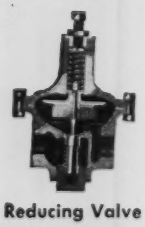
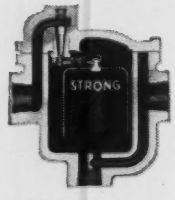


Reducing Valve



70 Series Trap

Strainer

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Copies of the standard are available for $1.00 from either SMA headquarters, 307 N. Michigan Ave., Chicago 1, or from BCR, 912 Oliver Bldg., Pittsburgh 22.

Tells How Stokers Reduce Boiler Plant Costs

Descriptions of layouts and tabulated data are used in a recent report to show how boiler plant operating labor and fuel costs can be reduced through the installation of efficient coal and ash handling equipment. Based upon a study at Battelle Memorial Institute, it covers plant sizes of 30, 90, 150, 225, and 300 hp.

All recommendations are presented on the basis of plant size, the necessary volumes of material to be handled, the investment, and reduction in operating costs. Comparative data are presented between coal and oil and between hand fired, semi-automatic, and automatic coal installations.

Titled How to Cut Small Boiler Plant Costs by Mechanical Coal and Ash Handling, the 16 page paper covered report is available from Bituminous Coal Research, Inc., 912 Oliver Bldg., Pittsburgh 22. The price is 40 cents and BCR member companies get a 40 percent discount.

ASRE Revises Standard for Rating and Testing Expansion Valves

Revised and approved by the American Society of Refrigerating Engineers, Standard No. 17-R, Method of Rating and Testing Refrigerant Expansion Valves, covers constant pressure and thermostatic valves in both the internal and external equalizer types. It lists and defines the terms used in rating, specifies the data required, establishes the conditions and methods of test, and specifies the method of determining the maximum pressure of thermostatic valves provided with pressure limiting means.

According to the standard, ratings must include four saturated temperature conditions at the valve outlets —40, —10, +20, and +40 F. The required saturation temperature at the valve inlet is 100 F (vapor free liquid). For thermostatic valves, superheat change should be 7 deg or less, though higher changes are permitted if specified as such. Similarly, a pressure change of 4 lb is recommended for constant pressure valves but ratings may be given for higher pressure changes if specified as such.

Priced at 50 cents, copies of the printed standard can be obtained from ASRE headquarters, 40 W. 40th St., New York 18.

Other Books and Reports Received

Fiat Review of German Science, Allied edition, published by the Office of Technical Services, Department of Commerce, Washington 25, D.C. Thirty two volumes of a projected 84 volume Fiat (Field Information Agency, Technical) review are available in printed form at $3.00 each. The manuscripts were prepared since World War II by several hundred German scientists. Among the subjects covered in the 32 volumes are biology, chemistry, mathematics, medicine, physics, and geology, with the main text being in German. A list of the publications now available may be obtained from OTS.

Commercial Standard for Domestic and Industrial Fuel Oils, sixth edition—This current revision was prepared by

the American Society for Testing Materials, and has been accepted by a large number of refiners, users, and testing laboratories. It is identified as Commercial Standard CS12-48 of the National Bureau of Standards and printed copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C. for 10 cents.

Handbook of Industrial Hazards from Explosive Dusts, by W. H. Geck—Is a two volume analysis of the nature and composition of dust, its origin, and its ignition. Released by the Office of Technical Services, Vol. 1 (PB 85197) is priced at $3.00 and contains a general discussion. Priced at $4.25, Vol. 2 (PB85198) discusses dust conditions in various industries and analyzes several hundred instances of officially confirmed explosions. Flour, coal, and aluminum industries are not covered. The text is in German with an abstract, a foreword, and table of contents in English. Copies may be purchased from the OTS, Department of Commerce, Washington 25, D.C.

Publications of the National Bureau of Standards—Identified as Circular 460, this 375 page booklet lists all bureau publications from 1901 to June 30, 1947, including mathematical tables, building materials and structures reports, circulars, handbooks, commercial standards, simplified practice recommendations, research papers, and miscellaneous publications. Copies are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. for 75 cents.

Automatic Arc and Gas Welding Processes as Used in the Automotive Industry, published by the American Welding Society, 33 W. 39th St., New York 18, and priced at 35c. While originally prepared from information on the use of welding processes in the automotive industry, much of the data is pertinent to other applications. Processes covered include submerged arc, atomic hydrogen, shielded metal arc, carbon arc, inert gas-metal arc, and oxyacetylene welding. The information contained is general and covers such factors as fit-up, current, backing, edge preparation, and speed of welding.

Letter Symbols for Physics (Z10.6-1948), published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, and priced at $1.00, has been approved by the American Standards Association and contains more than 900 symbols covering all common terms in elementary physics, some of the terms in advanced physics and related fields, and the principles governing symbol standardization.

Design for Welding, published by James F. Lincoln Arc Welding Foundation, Cleveland 1, over 1000 pages, 5½ x 7½ in., bound in simulated leather cover and priced at $2.00 in this country, $2.50 elsewhere. The book is composed of abstracts of 82 papers in the foundation's recent award program. Papers were selected and edited by Prof. R. S. Green, acting chairman, department of welding engineering, Ohio State University, so as to provide a record of representative welding designs. A good deal of cost data on various designs is included.

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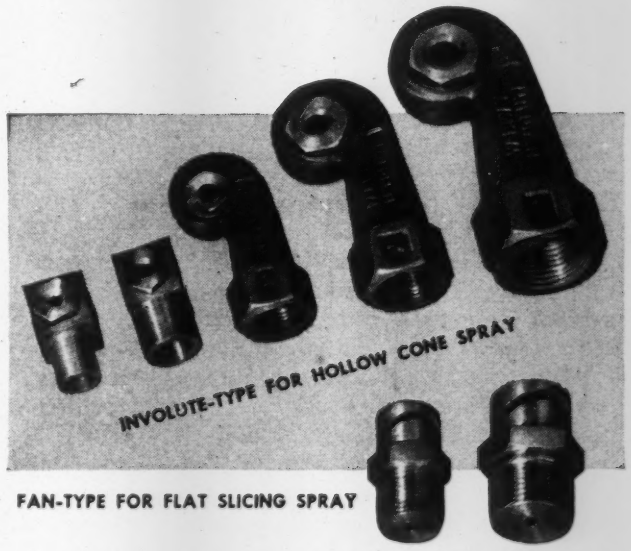

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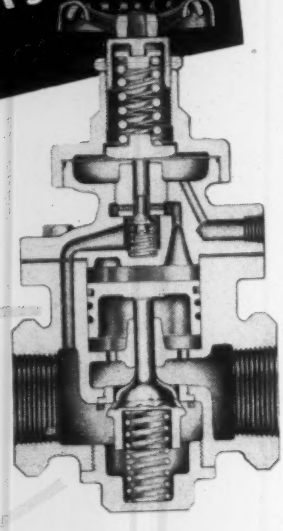

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Single seat design for tight shut-off in dead end service.

You can remove and renew any working part without removing the valve from the line.

For rugged build, convenient size and "close tolerance" regulation of steam—you just can't beat K&M's valve type 481.

It's an internal pilot-operated pressure regulating valve, widely used in process services and marine work as a primary valve on two stage reductions.

Changes in pressure reduction are made by setting the hand wheel. For complete specification data, ask for Bulletin 1000.

The Kieley & Mueller policy of continued pioneering has helped the K&M reputation grow constantly throughout the past 69 years. Look to K&M for: BACK PRESSURE REDUCING VALVES • PRESSURE REDUCING VALVES • STRAINERS • ATMOSPHERIC RELIEF VALVES • STOP and CHECK VALVES • STEAM SEPARATORS • GREASE EXTRACTORS.

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MEETINGS & CONVENTIONS

Heating and Air Conditioning Seminar—The fi[rst] annual seminar dealing with new developments in h[eat]ing and air conditioning will be held at New York Uni[ver]sity, will consist of 15 weekly evening meetings (beg[in]ning February 8), and is open to engineers and technical sales-men. The seminar will be conducted by a panel co[n]sisting of Mario C. Giannini, associated professor, New York University, Emory N. Kemler, research profess[or] and acting director of research, Peter B. Gordon, tre[as]urer, Wolff and Munier, and Victor L. Parsegian, di[rec]tor, physical research, Kellex Corp. Topics include th[e] heat pump, radiant panel heating and cooling, instrumen[ta]tion, and controls. Additional details may be obtained from Prof. S. G. Roth of the University's division of g[en]eral education, 100 Washington Square, E., New York 3.

Heat Pump Meetings—Dr. E. N. Kemler, research professor of mechanical engineering, New York University, will discuss the latest heat pump developments before the ASME student section at Yale University, February 16, the Morris County, New Jersey Engineers Club, March 15, and the ASME student section at Rhode Island State College, Kingston, April 17.

American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.—The following 1949 meetings have been scheduled:

Spring meeting and ASTM committee week, Edgewater Beach hotel, Chicago, February 28 to March 4.

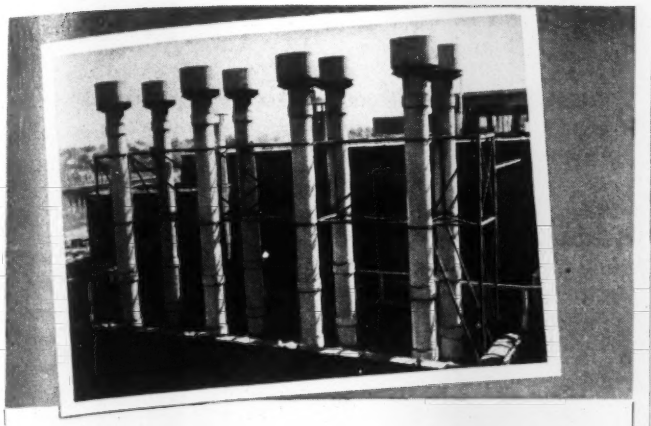
Fifty-second annual meeting, Chalfonte-Haddon Hall hotel, Atlantic City, June 27 to July 1.

First national meeting of the society on the west coast, Fairmont hotel, San Francisco, October 10 to 14.

National Warm Air Heating and Air Conditioning Association, 145 Public Square, Cleveland 14—Indoor Comfort Conferences will be held during February, March, and April in 10 cities located in Michigan, Indiana, Illinois, Minnesota, Nebraska, Missouri, New York, and Ohio. Each of the conferences (warm air heating schools) will consist of a three day instruction program.

Chicago Technical Conference and Production Show, March 14 to 17, Stevens hotel, Chicago.—Some 17 technical sessions are planned and will deal with equipment, methods, shop practice, processing, management, research, plant facilities, etc. Both the show and conference are sponsored by the Chicago Technical Societies Council, 53 W. Jackson Blvd., and its 55 affiliated societies.

8th Heating and Air Conditioning Conference—To be held at Iowa State College, Ames, Iowa, March 21 to 23, it is jointly sponsored by the college, the ASHVE Iowa chapter, and the Sheet Metal Contractors Association of Iowa. According to the tentative program, sessions will deal with trouble shooting, trends in institutional heating, boilers and combustion, panel heating, servicing air conditioning systems, warm air heating, and sheet metal problems.



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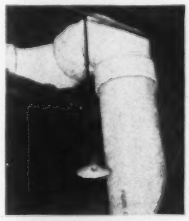
Workable: Transite can be cut and drilled on the job.

IN INSTALLATIONS in many industries where corrosive fumes, vapors, dusts, and gases are encountered, Transite Industrial Vent Pipe is yearly demonstrating the fact that it is a practical, economical answer to tough venting problems.

Because it is an asbestos-cement product, this strong, durable pipe stands up in many types of corrosive service . . . helps avoid costly replacement . . . results in important reductions in plant maintenance.

Easily installed—Transite Industrial Vent Pipe has many practical installation advantages. It is light in weight and easily handled. It is readily worked and can be quickly cut and drilled on the job with ordinary tools.



Adaptable: A complete line of Transite fittings meet most requirements.

Easily adapted—Made in a range of sizes up to 36" in diameter, Transite Industrial Vent Pipe is readily adapted to use as vents, ducts, and stacks. A full line of Transite fittings provides a venting system that is corrosion-resistant throughout.

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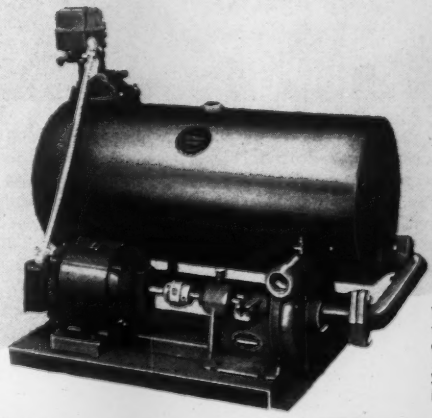

Write today for full technical data on these pumps illustrated or other SKIDMORE Pumps, Dept. A.

SKIDMORE Pumps

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NACE Conference and Exhibition—The fifth annual affair of the National Association of Corrosion Engineers, 67 Wall St., New York 5, will be held at the Netherland-Plaza hotel, Cincinnati, April 11 to 14.

The 11th Midwest Power Conference, April 18 to 20, Sherman hotel, Chicago.—Sponsored by Illinois Institute of Technology, 3300 S. Federal St., Chicago 16. Conference secretary is Dr. E. R. Whitehead, director, electrical engineering dept., Illinois Tech.

New Jersey Society of Professional Engineers, 86 E. State St., Trenton 8, N. J.—25th annual convention, to be held April 29 and 30, Essex House, Newark, N. J. A major feature will be industrial, engineering, and commercial exhibits.

American Foundrymen's Society, 222 W. Adams St., Chicago—1949 annual meeting, May 2 to 5, St. Louis, Mo.

Instrument Society of America, 1117 Wolfendale St., Pittsburgh 12.—The fourth annual spring meeting will be held at the Royal York hotel, Toronto, Canada, May 12 and 13. The tentative program indicates four technical sessions and a dinner. The 1949 conference and exhibit is scheduled for September 12 to 16 in St. Louis, and the 1950 convention and exhibit will be held in Buffalo, September 11 to 15.

Oil-Heat Institute of America, 6 E. 39th St., New York City—1949 national convention and National Oil-Heat Exposition, May 16 to 20, Boston. Convention headquarters will be the Statler hotel and the exposition will be in Mechanics Hall.

National District Heating Association, 827 N. [illegible] Ave., Pittsburgh 6—40th annual meeting, New [illegible] House, Swampscott, Mass., May 24 to 27.

Food Distribution Exposition—Sponsored by the [illegible]nited States Wholesale Grocers Association, the first [illegible]tional show to be devoted to all phases of the food distri[illegible]ution field will be held at the St. Louis Auditorium, Ma[illegible] 30 to June 1. Wholesalers' warehouse and office op[illegible]ation, store modernization, and merchandising methods w[illegible] feature the business sessions. Registration cards for [illegible]dmission may be obtained from Clapp and Poliak, I[illegible] 350 Fifth Ave., New York 1, show manager.

Fourth Annual Construction Industries Exposition and Home Show—June 2 to 12, Pan-Pacific Auditorium, Los Angeles. Designed to show commercial, residential, and industrial materials, products, techniques, and services it is owned and sponsored by 13 industry associations and the Los Angeles Chamber of Commerce.

American Society of Refrigerating Engineers, 40 W. 40th St., New York City—Spring meeting, June 5 to 8, aboard ship during a cruise from Montreal on the St. Lawrence and Saguenay rivers.

Heating, Piping & Air Conditioning Contractors National Association, 1250 Avenue of the Americas, New York 20—60th annual meeting, June 8 to 10, Hotel Statler, Detroit.

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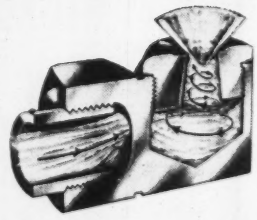
Redesigned to embody latest post-war improvements, Binks famous Rotojet Spray Nozzles set a new high standard in spraying efficiency! Constructed on the off-center inlet, whirl chamber principle, Binks Rotojet nozzles provide fine, uniform fluid break-up and distribution at pressure as low as 7 lbs. Nozzles are precision-machined from tough, marine bronze, also stainless steel and any special alloys that are machinable from bar stock. Internal surfaces are smooth and free from vanes and other obstructions. Available in a wide variety of sizes and capacities.



Send today for technical bulletin describing Binks ROTOJET Nozzles.

Bulletins give full information on sizes and capacities of the following Binks Rotojet Nozzles:

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10. Small and Medium Capacity Nozzles
11. Nozzles for Brine Spray Operation
12. Large Capacity Nozzles
13. Nozzles for Spray Ponds
14. Nozzles for Metal Cleaning Operations

Please state how nozzles will be used, and give capacity of installation.

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Wherever you are faced with the problem of piping refrigerant gases and liquids under varying degrees of temperature and vibration, Bendix Seamless Flexible Metal Hose is the perfect answer. Deep parallel corrugations, uniform wall thickness and seamless construction assure greater flexibility—longer service life.

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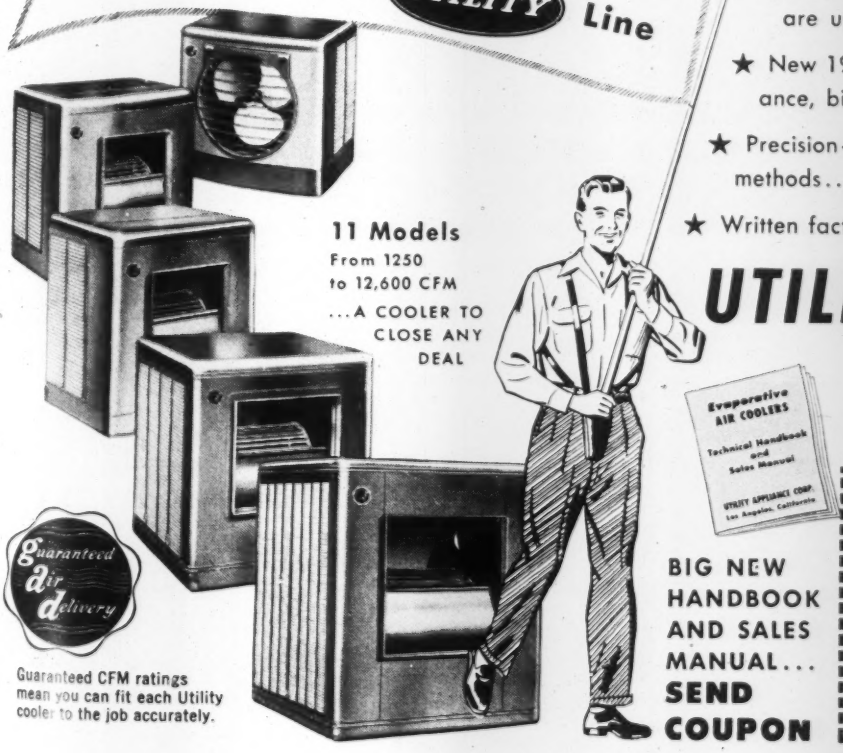

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RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 159. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

No. 7119: Acid Resistant Drain Pipe, Fittings—An instruction sheet for installing "Duriron" drain pipe and fittings covers cutting of the pipe, making joints, supporting lines, and allowing for expansion. The manufacturer is Duriron Co., Inc., 450 N. Findlay St., Dayton.

No. 7120: Air and Hydraulic Cylinder Data—Miller Motor Co., 4027 N. Kedzie Ave., Chicago 18, manufacturer of air and hydraulic cylinders, boosters, air hoists, counterbalance units, and related products, has published a chart giving data on push and pull stroke pressures for various cylinder sizes and piston rod diameters (at pressures from 50 to 3000 psi), the oil and air consumption of cylinders from 1½ to 20 in. bore, friction losses through pipe, valves, and fittings, and recommended piston rod diameters for various loadings and mountings. The chart is available in either the 8½ x 11 in. size or a larger size for wall mounting.

No. 7121: Air Conditioning, Refrigeration Equipment—A 16 page booklet about Baker Ice Machine Co., Inc., South Windham, Me., briefly covers the firm's progress and development since 1905, its present ownership and management, facilities, and products. Illustrated are "Freon" and ammonia compressors and condensers, self contained air conditioning units, evaporative condensers, unit coolers, liquid receivers, and accessories.

No. 7122: Air Conditioning Service Stations—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y., has issued a booklet listing all its representatives equipped to render marine service.

No. 7123: Air Diffuser Applications—The Vol. 4, No. 4 issue of Aspiration, the house organ of Anemostat Corp. of America, 10 E. 39th St., New York 16, features, descriptions of the United Air Lines maintenance base at San Francisco and the Los Angeles city ticket office of the Santa Fe Railroad. Uses of the company's air diffusers are illustrated. Also included is the first in a series of articles on fan fundamentals.

No. 7124: Air Velocity Meter—The unit developed by Hastings Instrument Co., Hampton, Va., is designed to measure velocities from 5 to 6000 fpm and utilizes the hot thermopile principle. It is described in Bulletin 1048.

No. 7125: Arc Welding Cast Iron—A special issue of the house organ published by Eutectic Welding Alloys Corp., 40 Worth St., New York 13, is devoted to "Eutectrode" 24/49, developed for arc welding cast iron without preheating. Illustrated case histories, with information on how repairs were done, are included and a page is devoted to the "Cuttrode" tool for cutting all metals.

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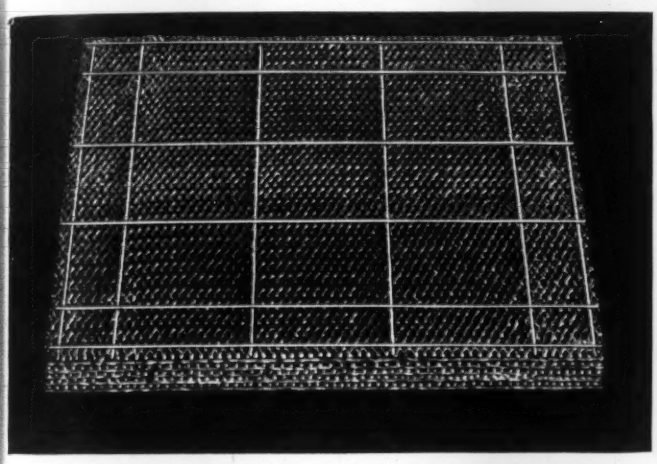
RP ALUMALOY* Self-Seal* AIR FILTER



This new R-P Air Filter combines for the first time the famous "Self-Seal" feature with the unique depth-filtration, dirt-stopping qualities of R-P ALUMALOY (Aluminum foil) filter media. The efficient "air scrubbing" multiple-layered baffle pattern with its thousands of adhesive dirt-catching surfaces is free of the usual integral frame. Made slightly oversize it fits snugly on all sides, providing filtering efficiency to the extreme edges and preventing by-passing of unfiltered air by "sealing" all edges. This means added dust-holding capacity and cleaner air for modern forced air units, air conditioning and ventilating applications.

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Whether you are selling in a competitive market or on jobs where price is not an important factor, you enjoy the confidence of your buyers when you specify Mueller Climatrol boilers. This is due to Mueller's national reputation for quality products.

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- ✓ Complete line of sizes and models for every residential or commercial heating or hot water application. Units can be installed for steam, hot water or vapor systems.
- ✓ Attractive, compact units with designed selling features. Mueller boilers are easy to install and service, provide highly efficient, economical and dependable operation.
- ✓ Types 10 and 11 boilers are A. G. A. approved for L-P gases as well as natural, mixed, and manufactured gases. All conform to A. S. M. E. code for low pressure boilers.

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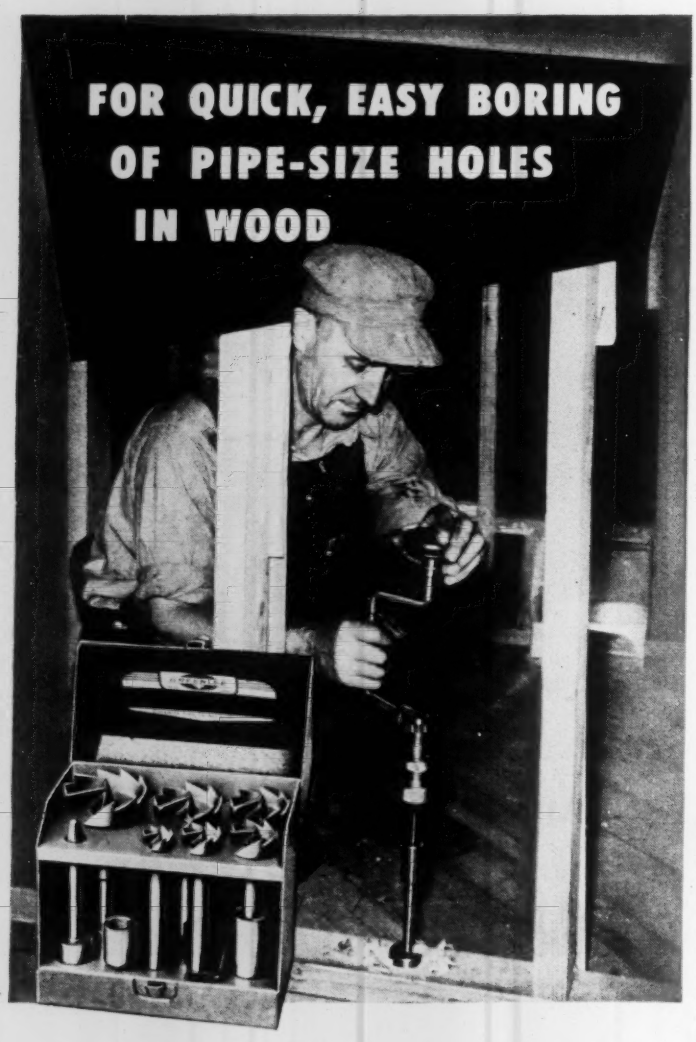
FOR GAS FOR OIL FOR COAL



. . . the new GREENLEE PIPE BIT SET

Designed especially for plumbers, steamfitters and electricians to provide fast, easy boring of accurate holes in wood for ½" to 2" pipe and conduit. Makes swift, easy work of an otherwise tedious, hard job! The set is furnished in a sturdy, attractive metal box with convenient carrying handle. Bits have ½" shanks for use in portable electric or pneumatic drills and in stationary boring machines. An adapter is provided for standard auger-bit braces. Adapters are also furnished for using standard ⅜" pipe as an extension for deeper boring and longer reach. Get facts today on these timesaving GREENLEE tools. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 2342 Twelfth Street, Rockford, Illinois.

TOOLS FOR CRAFTSMEN
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No. 7126: Ball Bearing Take-Up Unit—The new type LTU mechanical seal, ball bearing take-up unit is said to be especially suitable for conveyor construction, shaft adjustment, and belt tightening devices. Available in sizes from ¾ to 2-7/16 in., units incorporate prelubricated self aligning bearings. The manufacturer, Fafnir Bearing Co., New Britain, Conn., has released a specification sheet.

No. 7127: Boiler Water Conditioning—A 24 page bulletin, with emphasis on marine problems, provides general information on testing, analytical test procedures, water treatment, scale formation, and analyses of water supplies in U.S. and foreign ports. Published by O'Brien Industries, 84 Bishop St., Jersey City 4, N. J., the booklet also describes the applications and advantages of the company's soot remover, sludge solvent for fuel and diesel oils, and evaporator treatment.

No. 7128: Clips, Clamps, and Line Support Blocks—A 24 page catalog covers 3000 sizes and combinations of standard bare metal cushioned line support clamps and support blocks for industrial use. Information is given on material finishes, specifications, and available sizes offered in aluminum, steel, and stainless steel. New items added in this booklet include plate nut shims, wedge lock clamps, and ⅜ in. light weight clamps. The manufacturer is Thomas Associates 4607 Alger St., Los Angeles 26.

No. 7129: Controls for Hydro-Pneumatic Pressure Tanks—An article on controlling the air-water ratio in pressure tanks, by W. L. West, president, Automatic Control Co., 1005 University Ave., St. Paul 4, Minn., and published in Power, has been reprinted by the company. A formula relating tank withdrawal in gallons to high and low pressures is given.

No. 7130: Cooling Towers—Marley Co., Inc., Kansas City 15, Kans., has prepared a series of question-and-answer type monthly mail pieces entitled What's Your Cooling Tower I. Q. The first of the series deals with water distribution, the second with air movement, etc. Questions and answers are arranged so as to highlight features of the company's products.

No. 7131: Dew Point Recorders and Controllers—The "Dewcel" humidity sensitive element, power units, and both liquid expansion and electronic recorders are described and illustrated in Bulletin 407 published by Foxboro Co., Foxboro, Mass. Features of these units, designed for continuous measurement of dew point, are covered and the use of various controllers and strip chart recorders is also included.

No. 7132: Direct Expansion Evaporators and Finned Tube Condensers—Bell & Gossett Co., Morton Grove, Ill., has issued two new refrigeration bulletins. Catalog BJ-848 covers the "Hydro-Flo" direct expansion evaporators, discusses selection procedure, and includes diagrams on typical cooling systems. Catalog BK-948 features finned tube condensers in both straight tube and U bend models. Methods of selection, capacities, dimensions, and other data are given.

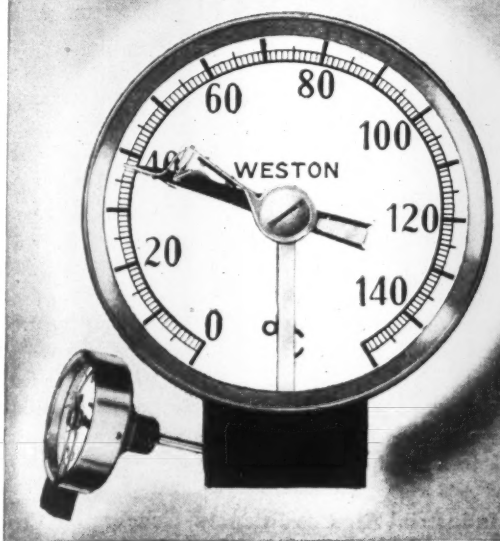
No. 7133: Electrode Holders, Ground Clamps, and Cable Connectors for Electric Welding—Equipment offered by

NEW—

all-metal WESTON

Contact-making

thermometer



This new Weston combines the features of an indicating device with the advantages of an alarm or control instrument. A contact arm, mounted as shown above, is easily set to make contact at any temperature on the scale.

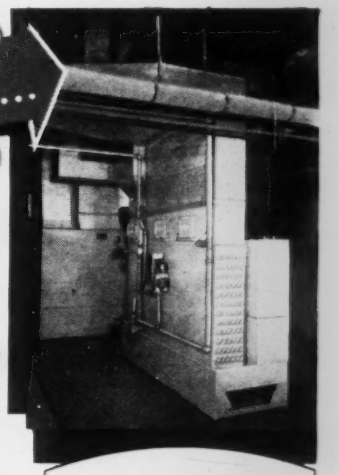
A terminal block on the periphery of the case makes electrical connection easy. The thermometer is all-metal, typically WESTON in ruggedness and reliability, with accuracy of ±1% as an indicating thermometer, and ±1½% as a contact making device. It is supplied in two types—for operation on either increasing or decreasing temperatures.

For complete information see your local WESTON representative or write Weston Electrical Instrument Corporation, 648 Frelinghuysen Avenue, Newark 5, New Jersey.

Industrial Thermometers | MAX-MIN Thermometers | Contact-making Thermometers

WESTON *Thermometers*

LABORATORY OR PRODUCTION LINE...



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CONTROL HUMIDITY TO JUST THE DESIRED AMOUNT

In the new and modern development building of a large petroleum products marketer there was recently installed Kathabar Package Units to provide year-round humidity conditioning for each individual laboratory. These applications included the following:

- Rubber, plastic, and latex lab. ... 76°F and 50% RH
- Physical lab. ... 74°F and 40% RH
- Process Research lab. ... 74°F and 40% RH
- Gas Analytical lab. ... 74°F and 40% RH
- Lube Group lab. ... 77°F and 50% RH
- Paint lab. ... 74°F and 40% RH
- Motor lab. ... 75°F and 40% RH

These Kathabar units can produce atmospheres ranging from below 10% to 50% relative humidities at 80°F, as the particular need may be.

Laboratory operations are exacting and that is why Kathabar Systems are installed where humidity is an important factor. Laboratory operations are usually small as compared with production lines but Kathabar units are dependable and accurate from the smallest package unit to a large central system.

Kathabar Humidity Conditioning has been proved in industry. Today there are over 300 installations in operation in the country's leading industrial plants and commercial establishments. Many of these installations are repeat orders. Why? *Because Kathabar Systems control humidity ... produce the desired results.*

GET THE FACTS • Ask a Kathabar Humidity Engineer to present proof of Kathabar dependability.

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Photographic Film Processing and Storage
Match Drying • Stencil Drying
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Processing of Sodium
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Gunpowder Processing
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(Corrosion Prevention)
Compressed Air Drying
Covered Cable Drying

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Cupola Dry Blast (Foundry)
Safety Glass Manufacturing
Magnesium Castings Production
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LEATHER
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Office Buildings
Banks • Dental Laboratories

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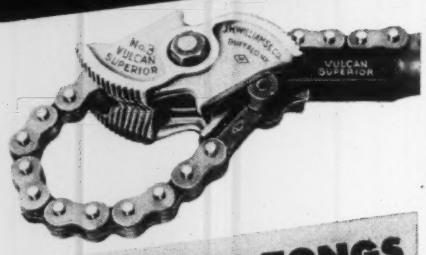

7 sizes, with either flat link or cable chain, for pipe and fittings 1/8 to 12".

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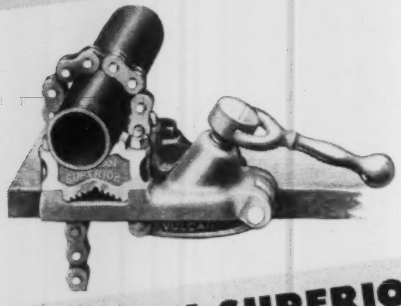
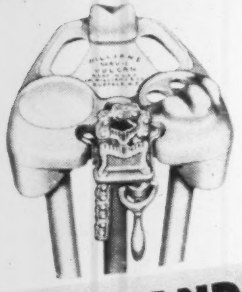


2 sizes, for pipe 1/8 to 4½". Handle is on top for easy operation.

"VULCAN SUPERIOR" VISES



"Vulcan" No. AV-1 for pipe 1/8 to 2". A light weight aluminum stand having same strength and rigidity as steel types weighing twice as much.

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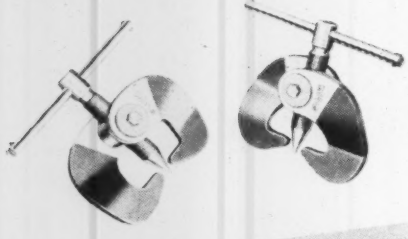

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Tweco Products Co., P. O. Box 666, Wichita 1, Kans., is illustrated in a 12 page catalog (No. 7). Also included are information on the care and maintenance of these products and a price schedule.

No. 7134: Flanged Pipe Joints, Insulation of Pipe and Fittings—The No. 4, 1948 issue of Valve World, the house organ of Crane Co., 836 S. Michigan Ave., Chicago, leads off with a discussion of the development and trends in the design of flanged joints, by E. G. Schmidt, company supervising engineer. His remarks, taken from a paper presented at last year's National Conference on Industrial Hydraulics, deal with the early type of full face gasket, the ring joint, the bellows type gasket, pressure seal joints, and "O" ring joints. Another article, by Utley W. Smith, manager, Magnesia Insulation Manufacturers Association, deals with the advantages of using 85 percent magnesia insulation for pipe, valves, fittings, etc.

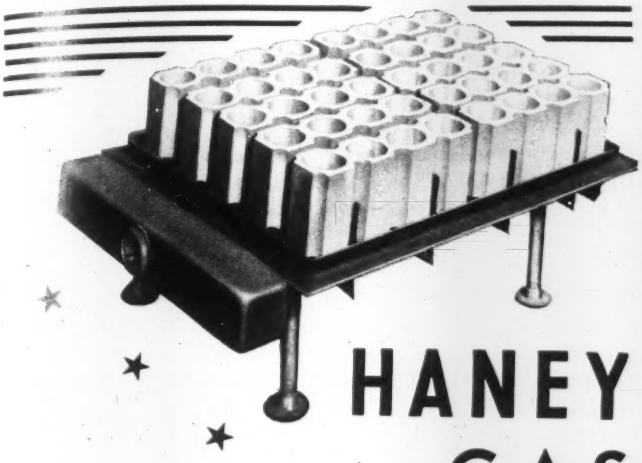
No. 7135: Heat Pump—"Solair" units (3 and 5 hp sizes) are briefly described in a new leaflet released by Northwest Heating, Inc., 1944 N. Lombard, Portland 3, Ore. Chief feature is said to be adaptability to various types and combinations of heat sources.

No. 7136: Induction Heaters—Electric Arc, Inc., 152-162 Jelliff Ave., Newark 8, N. J., has issued a bulletin on its line of induction heaters and control instruments for preheating before welding and stress relieving after welding. The new model U-P, for low frequency heating, is featured and is described as especially suitable for application in limited space and for use on heavy wall, special steel pipe, ¾ to 2 in. size.

No. 7137: Industrial Air Conditioners, Evaporative Condensers, Cooling Towers, and Product Coolers—Worthington Pump and Machinery Corp., Harrison, N. J., has issued several bulletins giving design and construction features, capacities, dimensions, etc. Series AHY and AVY air conditioning units for industrial and commercial applications (4 to 62 tons) are covered in Bulletin C-1100-B33. Series ECZ "Freon-12" evaporative condensers (11 to 54 tons) are the subject of Bulletin C-1100-B28. "Freon 12" product coolers, UCY series, in capacities from 3 to 37 tons are described on data sheet C-1100-S77 and the 3 and 5 ton cooling towers, series CTZ, are covered on data sheet C-1100-S72.

No. 7138: Industrial Gas Burner Assemblies—Capacities, specifications, dimensions, and alternative arrangements of "Pow-R-Semblies" (packaged industrial gas burner assemblies complete with pressure blowers) are given in Bulletin 7C, issued by Bryant Heater Co., Industrial Div., 1020 London Rd., Cleveland 10. Sizes range from 400,000 to 6,600,000 Btu per hr output.

No. **7139: Industrial Instruments**—Bulletin 98170, published by Taylor Instrument Companies, Rochester, N. Y., briefly covers the firm's entire industrial instrument line, including applications, principles of operation, and range limits. The bulletin is prefaced by the basic types of instruments as the first procedure in the process of selection. Succeeding pages divide the material according to the variables to be measured or controlled, such as temperature, humidity, pressure, flow, liquid level, force, and time cycle.



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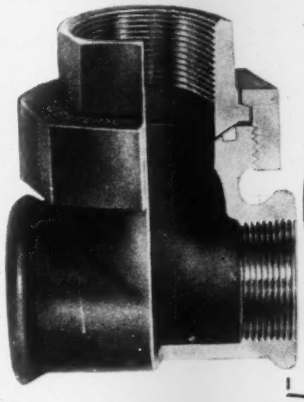

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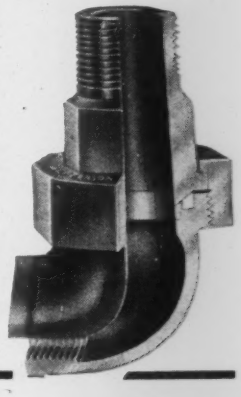

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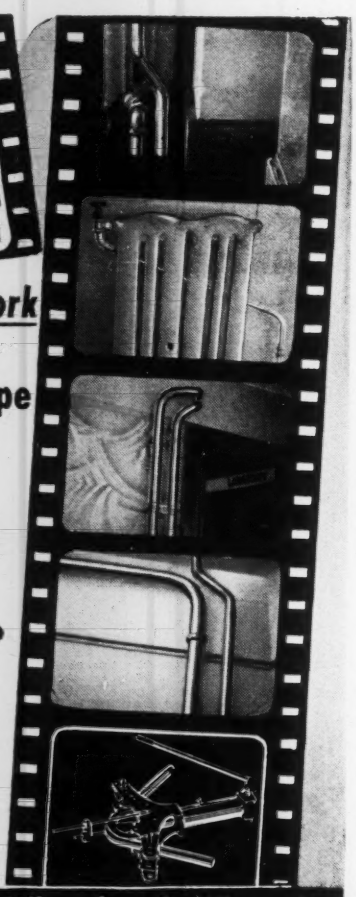

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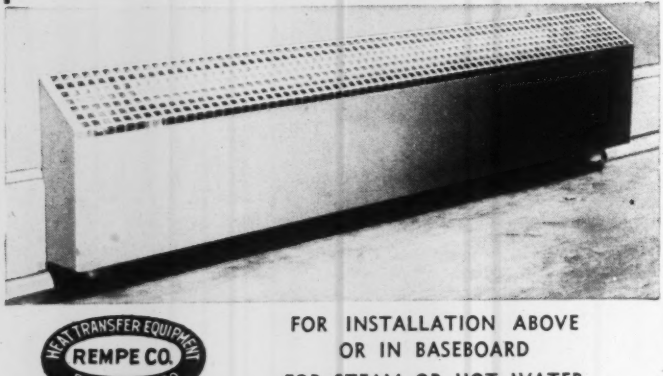

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No. 7140: Magnesia Insulation—Henry S. Curtis, manager of the new vinyl resin plant of Glenn L. Martin Co. Chemicals Division, Painesville, Ohio, describes the thermal insulation at this plastics plant in the Vol. 3 No. 1 issue of the house organ published by the Magnesia Insulation Manufacturers Association, 1317 F. St. N.W., Washington 4, D.C. Another article deals with continuous deodorization of edible oils in a Brazilian plant and also describes the use of 85 percent magnesia insulation. Current literature abstracts include one of Samuel R. Lewis' article on combining two steam plants to cut costs, published in the September 1948 issue of HPAC.

No. 7141: Metallizing Pump Parts—The Vol. 4 No. 5 issue of the house organ published by Metallizing Engineering Co., Inc., 38-14 30th St., Long Island City 1, N. Y., describes the savings which may be made by metallizing a wide range of pump parts, both centrifugal and reciprocating. Case histories in restoring such parts as shafts, hubs, sleeves, rods, plungers, and pistons are included.

No. 7142: Motor Mounted Pumps—Bulletin R-5500A released by Weil Pump Co., 1530 N. Fremont St., Chicago 22, covers units designed for numerous general and built-in applications. The RU pump has a packed stuffing box and the type RY features a mechanical seal. In addition to illustrating a number of applications, the booklet includes detailed information on dimensions, speeds, capacities, heads, etc.

No. 7143: Motor Starters—The a-c, across-the-line motor starters offered by Allis-Chalmers Mfg. Co., Milwaukee 1, are described and illustrated in a new 12 page bulletin (14B7132). Construction features and uses of manual, magnetic, combination, and reversing starters are covered, along with push button stations. Five different types of enclosures together with two types of thermal overload relays are also illustrated.

No. 7144—Odor Adsorber—Pur Air Div., American Solvent Recovery Corp., Eighth & Cassady Aves., Columbus 3, Ohio, has developed a unit for removing odors and gases from air. It consists essentially of a cabinet, fan, and activated carbon filters. Available in two models and especially recommended for use in enclosed spaces such as refrigerated compartments, it is described and illustrated in a new four page bulletin and on a data sheet.

No. 7145: Operating a Welding Business—A new 64 page booklet on how to start and operate a profitable welding business offers suggestions for job welding shops, sheet metal shops, machine and tool shops, etc. Copies are available for 10c (to cover postage and handling) from Hobart Bros. Co., Hobart Square, Troy 1, Ohio.

No. 7146: Protective Coating for Boilers, Other Equipment—"Apexior" No. 1, a protective coating for steam and water exposed surfaces in boilers, economizers, reheat units, turbines, evaporators, and deaerators, as well as process equipment, is described in Bulletin 1530 issued by Dampney Co. of America, Hyde Park, Boston 36. Functions, applications, and equipment are covered.

No. 7147: Refrigeration Valves and Fittings—A new 30 page illustrated catalog (No. 865) gives complete specifi-

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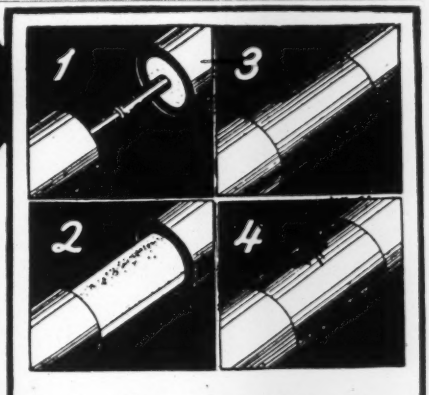

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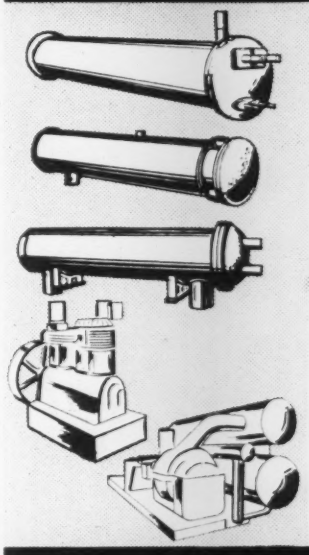

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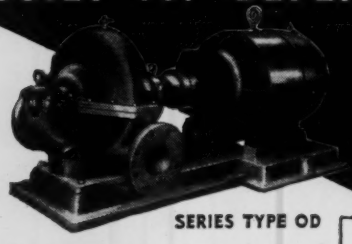

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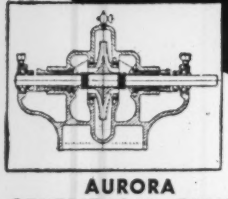

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No. 7148: Saddle Fitting Headers for Ceiling Panels—The "Brad-Way" method of installing 20 ft loops of copper tubing for ceiling panel radiation, utilizes a pair of saddle fitting headers channeled along opposite sides of a ceiling joist. Detailed information is given in a four page bulletin released by Jos. L. Bradfield, 10 N. Senate Ave., Indianapolis.

No. 7149: Safety Relief Valves—Catalog 80 on units for protecting boilers, compressors, heat exchangers, piping, pressure vessels, process equipment, regulators, etc. is available from Marine & Industrial Products Co., 1524 Vine St., Philadelphia 2. Designed for various liquids, vapors, and gases, valves are listed for pressures from 20 to 3000 psi, for temperatures up to 750 F, and in sizes from ½ to 6 in. Body materials include bronze, semi-steel, forged steel, cast steel, and a number of alloys.

No. 7150: Saving Heating Steam—Two articles on fuel economy and steam conservation, by William B. Pride, plant engineering dept., Boeing Airplane Co., Seattle, were published in the April and May 1948 issues of HPAC and have been reprinted recently by Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I. The company's shunt flow steam meter is also described and illustrated in the reprint, identified as Bulletin E4-400.

No. 7151: Small Motors—The new single bearing, shaded pole, a-c "Monomotors" introduced by Redmond Co., Inc., Owosso, Mich., are described in a four page booklet which covers construction details, ratings, and dimensions. Rated inputs are from 20 to 44 watts.

No. 7152: Sound Control—A 16 page bulletin covering noise quieting, acoustical correction, and vibration isolation, describes various products of Johns-Manville, 22 E 40th St., New York 16. Typical installations are illustrated and construction details show application methods.

No. 7153: Steam and Fluid Control Equipment—Detailed information on the use of its controls and specialties in five general types of steam heating systems is contained in a 20 page condensed catalog issued by Illinois Engineering Co., Inc., Racine Ave. at 21st St., Chicago 8. Also illustrated are radiator valves, thermostatic traps, strainers, control valves, etc.

No. 7154: Steam Engine Speed Control—The type EN self lubricated, enclosed governor for steam engines is covered in a four page bulletin (No. 502) released by Troy Engine & Machine Co., 20 Railroad Ave., Troy, Pa. The standard model, arranged for manual control, provides a 2:1 ratio of maximum to minimum speed. Special models permit control over 4:1 and 6:1 speed ranges.

No. 7155: Steam Humidifiers—Armstrong Machine Works, Three Rivers, Mich., has issued Bulletin No. 1771 on its line of steam humidifiers for automatically controlling relative humidity to prevent dry air damage to

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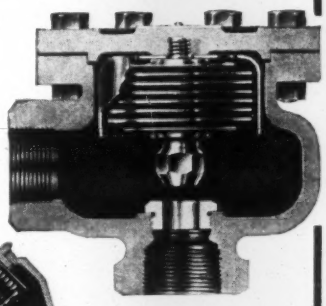

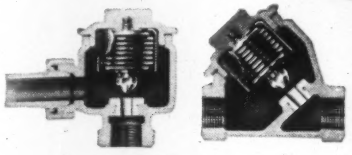

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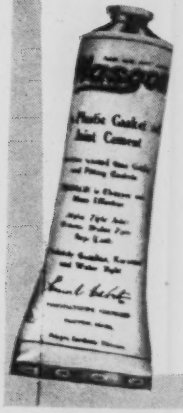

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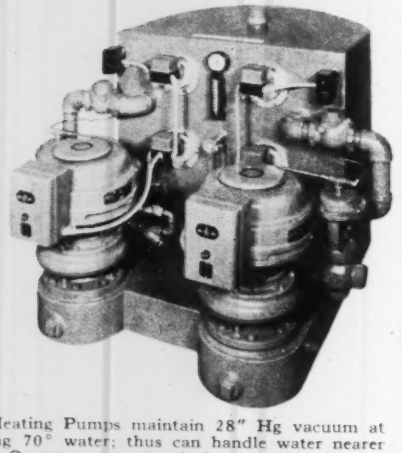

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hygroscopic materials such as paper, leather, wood work, foodstuffs, textiles, and other materials in storage or in process. The bulletin also describes the effect of relative humidity on comfort and health. Tables and charts on recommended relative humidities, regain of hygroscopic materials, and water content of saturated air at various temperatures are included. Also covered are the installation, operation, selection, and prices of eight models of the company's units.

No. 7156: Steam Specialties, Other Equipment—The Vol. 4, No. 1 issue of the house organ published by Yarnall-Waring Co., Mermaid Lane, Philadelphia 18, celebrates the firm's 40th year in the steam engineering field and is devoted to a history of its development.

No. 7157: Stud Welding—A new four page price list giving dimensions and other data on the line of 60 standard studs, designed for end welding with an automatic stud welding gun, has been released by Nelson Stud Welding Div., Morton-Gregory Corp., Lorain, Ohio. Also announced is a 32 page inventory listing over 1500 types, styles, and sizes of studs available for immediate delivery.

No. 7158: Thermocouples and Pyrometers—Issued by the Bristol Co., Waterbury 91, Conn., 65 page Bulletin P1238 also covers protection tubes and other pyrometer accessories. A technical section contains data on factors affecting thermocouple life, poisoning, corrosion, reproducibility, and insulation. A number of typical applications are illustrated and an indexed catalog section gives detailed information on the firm's complete line.

No. 7159: Torch Brazing Aluminum—Not all aluminum alloys can be successfully torch brazed. The Vol. 1, No. 9 issue of the house organ published by Reynolds Metals Co., 2500 S. Third St., Louisville 1, leads off with an article which explains why and gives information on those which can be brazed. Fluxes, procedures, and brazing alloys are covered.

No. 7160: Traps for Unit Heaters—How to select steam traps for unit heaters by the Btu rating method and the condensate weight method is the subject of an 8 page bulletin available from Armstrong Machine Works, Three Rivers, Mich. Data include listings of outputs, under standard conditions, of all sizes of unit heaters produced by 24 different manufacturers, conversion tables for varying conditions of pressure, temperature, and fan speed, together with recommended sizes of the company's traps for given heater capacities.

No. 7161: Turbine Driven Pumps—Types CC and CG units, designed for steam pressure up to 850 psi and back pressures to 200 psi, are available in capacities to 500 gpm and for heads to 2500 ft. J. S. Coffin, Jr., Co., 326 S. Dean St., Englewood, N. J., has published a four page bulletin (No. S) on these pumps which are recommended for boiler feed, condensate return, oil refinery charge, and other industrial applications.

No. 7162: Unit Heaters—Ilg Electric Ventilating Co., 2841 N. Crawford Ave., Chicago 41, has issued a new catalog (No. 348) on its line of unit heaters. According to the company, the booklet is virtually a data book because of the engineering information included. After enumerating the advantages of unit heaters for certain

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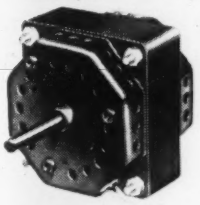

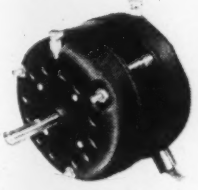

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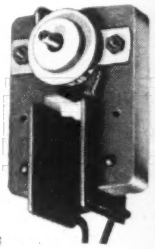

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